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ABSTRACT

The project aims to illustrate the extent of Native Indian scientific achievements and to correlate this information with the science concepts taught in schools; to make some practical suggestions to teachers and prospective teachers, in order to make science education more meaningful to Native Indian students; to propose a model of the process used to develop science curriculum material for these students; and to develop the "Turn-On Science Program" (TOSP) for Native Indian students. TOSP is designed for junior high school students who are disinterested in science and potential dropouts. The units cover: the technical world; environmental science; psychic drugs, alcohol, and you; Native Indian scientific knowledge; plants and Native peoples in British Columbia; suggested activities in physical sciences; and science is fun--Christmas and Easter chemical demonstrations, a science fair, and science and the national economy. Each unit describes its content, references, objectives, materials, examples, activities, and evaluation. These units utilize only the materials concerning Native Indians which the teacher can easily secure and is designed to provide useful scientific learning. Their organization is partly in the form of problems and the laboratory work is included as an integral part of the problem. A new approach to the examination and evaluation of science education for Native Indian students is provided. Additional suggested readings and biographical information of five successful Indians is included. (NQ)

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PROCESS FOR DEVELOPING
A TURN ON SCIENCE PROGRAM
FOR NATIVE INDIAN STUDENTS
AT THE SECONDARY LEVEL

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Educational Research Institute of British Columbia September, 1974

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PROCESS FOR DEVELOPING A "TURN-ON" SCIENCE PROGRAM
FOR NATIVE INDIAN STUDENTS
AT THE SECONDARY LEVEL

ABSTRACT

Most of the science teachers are aware that our most ignored students (Native Indian Students) are consistently disinterested in science and the lack of interest often results in failure in the subject. Because the science curriculum as it now exists presents a world which is alien to the Indian student, this disinterest should not come as a surprise.

In this project, an effort has been made to develop general guidelines for planning a curriculum for Native Indian students with a focus on their "cultural" and "social" values. In order to accomplish the above objective, visitation of Native Indian reserves has been done and there has been discussion of their "cultural", "social" and "psychological" values with members of the Indian community. (Refer to photographs found in Appendix I).

In this age of modern technology and academic achievement these Native Indian students are conscious of the phenomenal advancement of European and post European cultures, but at the same time they perceive that their culture has contributed little to the present syndrome of technology and feel it is too late for them to make a significant contribution to the society in which they must live. Nowhere is ruthless effacement of a peoples' pride in their own achievements more evident than in current educational practice regarding Native Indians. Here is a people whose culture was solidly technology based long before modern technology and science came into existence, yet this fact is ignored in the present teaching curriculum.

This study is based on the assumption that the Native Indian students may develop pride in their scientifically rich heritage, develop an interest in learning to understand the world in which they live through an understanding of technology, and consequently achieve satisfaction from success.

This study has four major purposes:

The first is to illustrate the extent of Native Indian scientific achievements and to try to correlate the resulting information with the science concepts taught in schools.

The second purpose of this study is to make some practical suggestions to teachers and prospective teachers, in order to make the science education more meaningful to the Native Indian students.

The third purpose of this study is to propose "a model" of the process

of development of a science education curriculum for the Native students. This process may be applied to the development of programs in other school subjects for children of other minority ethnic groups.

The fourth purpose of this study is to develop a science program entitled "Turn-On Science Program for Native Indian Students at the Secondary Level." The writer intends to send the above program to some practising science teachers in British Columbia in order to have feed back which should be useful in making desired changes in the proposed program.

R.M.K.

I remember all those thousands of hours

That I spent in Science class watching the clock.

Watching for Recess or Lunch or to go home.

Watching for any thing but Science class.

My teacher could easily have ridden with Jesse James.

For all the time they stole from me.

Anon.

(Native Indian Student)

PREFACE

In this project the writer has given some general suggestions regarding the course content, evaluation and desirable teaching environments for imparting meaningful science education to our Native Indian students. The suggestions mentioned in this project are felt to be generally desirable, rather than absolutely necessary to the teaching environment. It should be kept in mind that these suggestions are not meant to be prescriptive nor are they necessarily applicable in all situations.

The present study is limited to the Native Indian tribes or bands as mentioned in the project.

Due to cultural and social diversity of various Indian tribes, it would be hazardous to apply the research findings in this study to other Native Indian tribes or bands without study of the effectiveness of proposals growing out of the present study.

This project may be taken as a resource material for developing a science program for our Native Indian students.

R.M.K.

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CHAPTER 1

OVERVIEW OF THE PROBLEM OF INDIAN EDUCATION
WITH SPECIAL REFERENCE
TO SCIENCE EDUCATION

CHAPTER I

Overview of the Problem of Indian Education With Special Reference to Science Education

Most teachers (especially Science teachers) are aware that most of our Native Indian students are consistently disinterested in school and this lack of interest often results in failure in our school system.[1] Because the curriculum in our schools as it now exists presents a world which is alien to these students, this disinterest and resulting failure should not come as a surprise. A student's interest is aroused only when he perceives something of value in the School or sees a practical application of the knowledge to be gained.

The new curricula in various school subjects such as Social Studies, English, Mathematics and Science have not revealed any real concern with the problem of presenting those subjects to our Native Indian students. But at the same time, it is unlikely that any single curriculum in any subject will meet the needs of all Native Indian students. While these newer curricula may go a long way toward fulfilling the needs of many students it appears that something further is needed to meet the needs of our Native Indian students.

In order to design a program for Native Indians in any school subject, it is imperative to review the problem of Indian Education in general; first on a national level, and then on the provincial level. The following statistical information provides an overview of Indian Education:

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[1] R.M. Kalra, New Directions for Imparting Meaningful Science Education to Native Indian Students (Hilroy Fellowship Project), Ottawa: Canadian Teachers' Federation, 1970, p. 18-61

TABLE I

Enrolment of Indian Pupils in Elementary and Secondary Non-Federal Schools Classified by Grade and by Province, School Year 1969 - 70[2]

GRADE	P.E.I. No.	N.S. No.	N.B. No.	QUE. No.	ONT. No.	MAN. No.	SASK. No.	ALTA. No.	B.C. No.	TOTAL No.
Pre-grade 1		103		262	307	288	317	204	608	2,089
Grade										
1	1	68	34	256	539	572	1,148	662	1,175	4,455
2	2	54	39	285	540	505	864	581	885	3,755
3	1	51	30	275	464	451	786	537	786	3,381
4	1	44	65	243	533	388	676	540	734	3,224
5	1	48	109	265	579	378	658	521	783	3,342
6	2	44	121	381	553	409	572	548	797	3,427
7	2	73	84	509	635	405	571	459	730	3,468
8	4	63	77	521	506	337	375	403	856	3,142
9	3	55	51	314	939	440	318	405	678	3,203
10	2	31	37	200	640	306	213	307	435	2,171
11	1	13	21	152	322	181	116	162	275	1,243
12	-	13	12	39	268	107	81	[illegible]	195	853
13	-	-	-	-	42	-	-	-	-	42
TOTAL	20	669	681	3,735	7,276	4,909	6,792	5,564	9,191	38,837

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[2] *Canada Year Book*, Ottawa: Information Canada, 1972, p. 207-209

TABLE II

Enrolment of Indian Pupils in Elementary and Secondary Schools Classified by Type of School and by Grade, School Years Ended 1966 - 70[3]

Year and type of School	Grade				Special	Absent from Reserve	Total
	Pre-1	1-6	7-8	9-13			
	No.	No.	No.	No.	No.	No.	No.
1965-66	3,660	38,929	7,107	5,220	1,013	5,466	61,395
Federal	3,093	24,566	3,203	716	462	-	32,040
Non-Federal	567	14,363	3,904	4,504	551	5,466	29,355
1966-67	3,830	40,408	7,453	5,510	1,081	6,157	64,439
Federal[2]	2,939	24,672	3,093	427	210	157	31,498
Non-Federal	891	15,736	4,360	5,083	871	6,000	32,941
1967-68	4,531	40,188	7,926	5,967	1,305		66,217
Federal	3,513	24,524	2,879	307	359		31,582
Non-Federal	1,018	15,047	5,047	5,660	946		34,635
1968-69	5,916	40,331	8,250	6,832	1,505		62,834
Federal	4,363	21,845	2,720	209	346		29,483
Non-Federal	1,553	18,486	5,530	6,623	1,159		33,351
1969-70	6,781	41,764	9,191	7,761	1,210		66,707
Federal	4,692	20,180	2,581	249	168		27,870
Non-Federal	2,089	21,584	6,610	7,512	1,042		38,837

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[3] Canada Year Book, Op, Cit, p. 208

TABLE III

Indian Students in Post-Secondary and Vocational Training by Province, School Year - 1969 - 70[4]

(exclusive of the Yukon and Northwest Territories)

Classification	PEI. N.S. & N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Canada
	No.	No.	No.	No.	No.	No.	No.	No.
University	12	37	74	33	56	52	57	321
Teacher Training	4	7	3	7	-	3	25	49
Nurse Training	2	3	10	2	-	5	2	24
Vocational	244	1,002	1,703	296	493	286	511	4,535
Upgrading	299	927	-	925	1,108	173	465	3,888

TABLE IV

Progress of Indian Students Through a Twelve Year School Cycle[5]

Grade	Year	Enrolment	Loss No.	Loss %
1	1951	8,782	-	-
2	1952	4,544	4,238	48.2
3	1953	3,930	614	13.5
4	1954	3,652	278	7.1
5	1955	3,088	564	15.5
6	1956	2,641	447	19.5
7	1957	2,091	551	21.7
8	1958	1,536	554	26.5
9	1959	1,149	387	25.5
10	1960	730	419	36.5
11	1961	482	248	34.0
12	1962	341	149	29.3

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[4] Ibid, p. 208

[5] H.B. Hawthorn, A Survey of the Contemporary Indians of Canada: (Ottawa: Indian Affairs Branch, Vol. 11, 1967), p. 130

Analysis of the above statistical information (especially Table IV) shows the rate of grade repetition and of dropouts on a national level is extremely high. Most of the failures are in the core subjects - English, Science and Mathematics.

Let us look at the problem of the B.C. Native Indian education. The above deplorable situation exists in British Columbia as evidenced by the following information provided by the Indian Education Resources Center:

- In 1968 there were about 12,500 status Indian children in schools, but only 132 in grade 12. How many of these graduated is not known. On the average, then, only about 1 - 2% of all Indian children graduate from secondary school.

- There are roughly 23,000 teachers in B.C. provincial schools. Five percent of all B.C. residents are Indian. If 5% of all B.C. provincial school teachers were Indian there would be 1,150 Indian teachers. This year (1973-74) there are only 20 Indians teaching.

- Over 1/3 of all Indians in B.C. depend on welfare, as compared to 1/16 of the total population.

- Indians are distinctly under-represented in the skilled and professional occupations.

- Indians are over-represented in penal institutions.[6]

The above information points out that Indian students are not benefiting from the school system.

In the opinion of this author, the above failure is partly due to the structure of the present system of education, a structure which is based on the assumption that individuals in various Canadian sub-cultures will respond to the opportunity to receive education, and that those individuals will understand its value to themselves, their families and their communities. If an individual Indian does not reach this level, of course, he is just a dumb Indian. As a result of this assumption which implies that our culture is the best, very little credit is given to their rich Indian cultural heritage in the present system of education.

The fallacy of this assumption has been aptly described by Chief Dan George, "Don't strip a man of his clothing and ask him why he is naked .... Don't filch a man of his authority - his right to rule his home - his dignity as a man, then ask him why his culture is substandard"[7]

Manipulation of the physical world is the very strength that western culture has to offer and we say, "If only we could teach these uneducated and uncivilized native Indian students to think logically, that is, scientifically, to bring them into the 20th century and get them to abandon their obviously unsuccessful customs, they would be better equipped to handle the problems and live more productive lives." The trouble with this type of thinking however, is that there is enough truth in it to validate the demands for more technological education; but also enough narrowness and over simplification to trap the unwary into believing that indeed technology is a complete system of thought and therefore the key to heaven's gate.

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[6] Indian Education, (Teacher Training), Vancouver: Indian Education Resources Center, a statement by B.C. Native Indian Teachers Assn. Feb.1974,pp 1-2

[7] Chief Dan George, Canadian Conference of Social Welfare, Vancouver (B.C.) 1967

It is the opinion of this writer that there is a great danger in science as a singular value system, for if the weakness of various ethnic cultures is their resistance to scientific thinking, then there has been equal stubborness on the part of western-scientific culture in its over commitment to technology. The historical record of all great civilizations tells us that cultural idealism and technology must exist side by side. Great engineering masterpieces in all ethnic cultures give testimony that science and technology are many thousands of years old and that what the westerners call the "industrial revolution" only means an unprecedented acceleration and exceedingly strong emphasis on this aspect of human activity. The fact is that five or six thousand years ago the rise of the great civilizations was not brought about by technology alone, but by radically new social inventions. In spite of the westerner's affluence, his overwhelming commitment to Industrial affluence appears to be at the expense of his health and mental balance, and with the advent of the hydrogen bomb, his very survival.[7a]

In this age of modern technology and academic knowledge these Native Indian students are conscious of the phenomenal advancement of European and post European cultures, but at the same time they perceive that their own culture has contributed little to the present syndrome of technology and feel it is too late for them to make a significant contribution to the society in which they must live. Nowhere is ruthless effacement of a people's pride in their own achievements more evident than in current education practice as it affects Native Indians. Here is a people whose culture was solidly science based long before modern technology came into existence, yet this fact is ignored in the present teaching curriculum. Have their achievements in applied science, agriculture, construction and mathematical manipulations been so useless as to be given no consideration in the present curriculum? The author is not consciously digressing from his purpose here, but only seeking to suggest new directions for imparting meaningful Science education to the Native Indian students.

Thus, in order to arouse interest in Science among our Native Indian students, the author in this project has made an attempt to design a "Turn-On" Science Program for Native Indian Students With a Focus on Values. Also, some practical suggestions for developing pride in Indian scientific contributions have also been discussed. A series of suggested outlines is provided.

Implications for Further Research

The writer believes that what is needed is the development of a model of the process used to develop curriculum materials which embody responsiveness to the needs of our Native Indian students in various school subjects.

[7a] Feringer, F.G. and R.M. Kalra, "Science Education for Adults in India." Journal of Science Teacher. New Delhi: All India Science Teachers' Assoc. De., 1970, p. 1-7

Thus, the writer intends to develop the necessary model and design a science program, ready for use by the teacher, by taking into consideration the various factors which have been discussed in this project (refer to Ch. II and Ch. III).

The proposed science course will be organized into units, each of which will relate to some significant aspect of Native Indian environment. The organization will be in the form of problems and the laboratory work will be included as an integral part of the problem solving.

CHAPTER II

Turn-On Science Program For Native Indian Students With a Focus on Values

The author through his experience and contacts with educators in the North American continent, believes that the newer curricula in science education offer no solutions to the problems of teaching science to the Native Indian students. While these newer curricula may go a long way to filling the needs of the average students, it appears that something further is needed to meet the needs of Native Indian students.

What, then, should be the nature of science education for Native Indian students?

Basically, a totally new system of science education is needed that will enable young students to develop skills and acquire knowledge which has a higher probability of producing a better understanding of their environment, and which will make possible for the students an acquaintance with the process of discovery of knowledge. Such a curriculum in science would lay emphasis on the practical understanding of science. Such a curriculum would not lay emphasis on theoretical and scientific principles that are unrelated to the student's daily life, but rather the emphasis would be placed on the application of scientific knowledge to the improvement of living conditions, and to other aspects of everyday life.

Thus, the author, in this project has proposed a TURN-ON SCIENCE PROGRAM for Native Indian high school students. A unique feature in this program is an illustration of Native Indian scientific achievements. The author has tried to correlate some of those achievements with the science concepts taught in schools. Hopefully, the North American Indian students may develop pride in their scientifically rich heritage, develop an interest in learning to understand the world in which they live through an understanding of science, and consequently achieve satisfaction from success.

A. Philosophy of T.O.S.P. (Turn-On Science Program)

A philosophy of science teaching consists of aims and objectives of teaching in general and of science teaching in particular. For this reason a science teacher needs some understanding of educational philosophy. The objectives are derived from the philosophy. The objectives of science teaching may be classified into categories which are different in scope. The kind of science education advocated for these students by this writer is categorized below.

The first aim of science teaching in this program (Turn-On Science Program) is that the students shall demonstrate a knowledge of the fundamentals of science. The major objective of the discipline of science has been, and will continue to be, the discovery and confirmation of new knowledge, the establishment of general laws or truth. Any new course must contain this historic objective as any current curriculum must build upon the past.

The proposed course is introductory in nature and should help to familiarize students with the fundamentals of science suiting their intellectual capacity, needs and interests.

In the opinion of this writer, the basic aim of science teaching in the high schools must be to supply foundational knowledge of science which may be brought into use in daily life.

Thus, the main object of the designed course in science is to provide a systematic and practical idea of the discipline of science and to change student behaviour through this knowledge.

The second aim of science teaching to the Native Indian students is that the student shall demonstrate knowledge of the contributions made by Native Indian people in the scientific world. In the opinion of this writer, an important thing for a science teacher to do in the high schools is to develop pride in the contributions made by Native Indian people in scientific literature. It is necessary for a science teacher to believe in the competence of the Native Indian people. The teacher must stress their achievements in science in class so that students may develop pride in their scientifically rich heritage and consequently in themselves.

The third aim is the implementation of seven cardinal principles of education recognized in the U.S. They are: (1) health, (2) command of fundamental processes, (3) worthy home membership, (4) vocation, (5) citizenship, (6) worthy use of leisure, and (7) ethical character.[8]

The fourth aim is that students should demonstrate abilities which are the by-product of the knowledge. If the students have acquired scientific knowledge from the designed course, they consequently should develop abilities to behave scientifically. In order to achieve the above aim, that the students should behave scientifically, the designed course should inculcate the following scientific habits:

(a) The power of observation
(b) The Ability to use the common laboratory equipment
(c) The ability to locate, evaluate and generalize problems

The fifth object of science teaching is to demonstrate the ability to apply what is learned to practical situations in the community for the improvement of life.

---

[8] Commission on the Reorganization of Secondary Education, Cardinal Principles of Secondary Education, U.S. Bureau of Education, Bulletin 35, Government Printing Office, Washington, D.C. 1918, p.30

The sixth important aim of science teaching in the high schools is to make the students into more alert citizens and better equipped to improve the community life. In order to achieve this aim, the course content in science should have practical applications to daily life. The relationship of science instruction to the school's attempt to help every individual lead a worthwhile life is admirably stated by Brunson and Dowling.

> A responsibility of the school is to help every individual to lead a worthwhile life. Those situations which can be better met by an understanding of the basic concept of science become facts of science instruction. Physical and mental health which are affected by sleep, rest, fatigue, diet, exercise, posture and drugs can be assumed for the public. Self assurance, which comes from a sense of achievement and understanding of normal variability, is necessary to the best adjustment and can be built by the study of chemistry. Through an understanding of organic and inorganic changes, the pupil gains appreciations which help him to see himself in his proper place with relation to the world about him. By constant practice in recognizing problems, seeking evidence to be weighed and arriving at the conclusions, the scientific method becomes a basis for action with the pupil. Science can help present certain fundamental principles which should be understood through partaking in and preparing for home making.[9]

To summarize, a philosophy of this Turn-on science program is based on a new system of science education that will enable the Native Indian students to develop skills and acquire knowledge which will produce a better way of life for them and which will make it possible to lead the students to the discovery of knowledge.

Thus, in the opinion of this writer, the science program should be aimed at raising the level of scientific knowledge, skills and attitudes of the students to allow them to be more productive in their home environments. To accomplish this, science must be taught on three levels: the facts level, the concept level and the values level. For example, in teaching a unit on water, the teacher might pose the following questions:

WATER

Level I (facts)

(1) In how many physical states does water exist?
(2) What are the common sources of water?
(3) What are the methods of making water potable?
(4) What are common solvents?
(5) What is the chemical composition of water?

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[9] Brunson and Dowling. Suggestions For the Teaching of Science in Twelve Year Program (South Carolina: Department of Education Publication) p. 47

Level II (concepts)

(1) Demonstrate via certain lab experiments the various methods employed in purifying water.
(2) How do you know water is pure?
(3) What are the effects of drinking impure water?
(4) Demonstrate, via lab experiment, the chemical composition of water.

Level III (values)

(1) Why is water important to you?
(2) What would you do without water?
(3) Is the drinking water in your community fit for drinking?
(4) If not, make a list of things you could do in your community to improve the quality of drinking water.
(5) What action if any, are you going to take along these lines?

Notice the emphasis on the "you" in each of the above values level questions (Level III). Although questions in Level I and II may recognize application in today's world, they do not become Level III questions until they are directly related to the students' daily lives, environments and attitudes.

Here is another example, this time in the subject of food:

OUR FOOD

Level I (facts)

(1) What is the chemical composition of the human body?
(2) What is food made of?
(3) What are the different food substances?
(4) What are some common vitamins?
(5) How is food digested?

Level II (concepts)

(1) Demonstrate via laboratory experiment that a living organism is made up of little divisions called cells.
(2) What happens to food you eat?
(3) What is the importance of proteins in our food?
(4) What are the advantages of a well balanced diet?
(5) What is the result of a poor diet?
(6) How do vitamins help our body?

Level III (values)

(1) Why do we eat?
(2) Write a report containing two columns. Head one, "Foods I Must Add to My Diet." Head the other, "Undesirable Foods I Have Eaten."
(3) Make a list of the foods you have eaten during the past two days and compare it with the list of foods given in your textbooks. Are you getting enough vitamins?

Let us take another example of material in this program. This time the subject is the concept of machine, which is commonly discussed in a science class:

Level I (facts)

(1) What is a lever?
(2) How many kinds of lever are there?
(3) Describe the simplest form of lever indicating the position of fulcrum, the resistance arm and the effort arm.
(4) What are simple machines?
(5) How is a flag raised to the top of a pole?

Level II (concepts)

(1) Draw diagrams of each type of lever showing the position of the fulcrum, effort and resistance.
(2) One of the following items is not classified as a lever. Underline that item.
(a) screw (b) nut cracker (c) scissors (d) hammer
(3) Use a bar 10 feet long for the lever and a 20 pound weight for the resistance. Measure the effort with a spring balance and the distance with a metre rod.

Level III (values)

(1) How do levers help you in your daily life?
(2) What machines do you use at home?
(3) List all the simple machines you have at your house. Try to discover all the ways these machines could be used to help you do your work.
(4) Make a list of some ways you could help others in your community learn to use simple machines.
(5) Make a list of the advantages and disadvantages to be gained by using simple machines to help you in your work.

All the questions in the units on water, food and machines discussed above are merely suggestive of what a science teacher might ask. Different teachers may ask different value questions. But a teacher should be careful not to insist on one right answer for these questions.

Furthermore, a teacher should make his point of view clear to the students without trying to impose his values on the students.[10]

The author wants to emphasize that Levels I & II (Fact Level and the Concept Level) are very important in science teaching. The Major discipline of science has been, and will continue to be, the discovery and confirmation of new knowledge, and the establishment of general laws or truth. But, in addition, Level III (Value Level) is also important because this level directly relates science to the student's own life. Level III questions help to provide students with a systematic and practical idea of the discipline of science and encourage them to change their behaviour by applying this knowledge to their own lives. It is unfortunate to have to point out that the Values Level (Level III) is often ignored in science teaching in our schools.

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[10] Louis E. Raths, Merrill Harmin and Sidney B. Simon, Values and Teaching; (Columbus, Ohio, A. Charles E. Merrill) 1972, p. 78-81

B. Bases on Which T.O.S.P. (Turn-On Science Program) is to be Designed.

To understand adequately the role of science education in the Native Indian community, it is necessary to ask the following question:

What are the major problems of the Indian community which science should prepare the children to tackle intelligently and purposefully?

In the first place, an Indian reserve is a community where all people work, or at least under socially healthy conditions all should work. And this work is practical. Also, on the reserves there are many problems of sanitation, health and hygiene, and water pollution. This implies the designing of a curriculum, particularly in science, which is closely related to the real problems of the community life and which is so presented that the conventional gap between school knowledge and life situations disappear.

In the opinion of this writer, if the science curriculum remains as bookish as it is at present, if in the organization of its time table and teaching methods and discipline it does not allow for the special needs and problems of the Native Indian people, it will fail to obtain the support of these people. The first problem is to transform schools into miniature communities where the child learns through applying knowledge. In order to achieve this aim, the curriculum in science should be based on the needs of the community.

The next problem is to bring the school out of its isolation and connect it with all the worthy aspects of community life. This involves the utilization in school of the child's outside experiences, the basing of his studies on and integrating them with the knowledge and information and interests he brings with him to school. A science teacher can do much towards the betterment of community life and incidentally, towards the establishment of his own position and prestige in the community. It is not merely the teacher who has to make himself the center of community life and a radiating source of light and learning, but it is the school as a whole that has to assume this position. The advantages of such an educational approach are obvious. The school becomes the center of community life.

The second factor to be taken into consideration while designing the curriculum is the need of adolescents in economic relationships consistent with community structure. In order to achieve the above aim, the designed curriculum should also be vocational in nature, and this might be a terminal course which may help the students to get a job.

The third factor to be taken into consideration is the educational level of the students. The designed curriculum would be based on the science education which students received earlier.

The fourth factor for curriculum design is the availability of the materials, library and laboratory tools. The designed curriculum should emphasize the utilization of local resources.

The fifth and the last factor for curriculum design is the knowledge of the basic concepts in the discipline of science. Unless the students have sound fundamentals of any knowledge, they will find it quite impossible to transform the knowledge for use in a variety of situations.

C. Organization of the Turn-On Science Program (T.O.S.P.)

Listed below are some of the guiding principles which will be followed in the development of the above program:

1. The curriculum shall be organized into units each of which shall be related to some significant aspect of the environment.
2. The unit will be essentially a major problem of every day life to which science may contribute an intelligent basis for human adjustment.
3. Each unit shall include only a few principles of generalizations of science.
4. The organization, in part at least, shall be in the form of problems or projects to ensure education in problem solving, which is the nature of science.
5. The distribution of time and emphasis to various units shall be determined by the total functional and social value; the "teachability" and "learnability";the teachers' and pupils' interest in the unit; the local significance of the unit; and its value to other units of the course.
6. The laboratory work shall be included as an integral part of the problem solving and shall, therefore, have the characteristics of experience and should de-emphasize illustrative or conformatory work.
7. The organization of the course shall be such that it will lead to the attainment of the immediate and ultimate objectives.

CHAPTER III

Some Illustrations of the Extent Of Native Indian Scientific Knowledge

Native Indians applied sophisticated scientific knowledge to almost every dimension of their life. In the realm of clothing, construction of dwellings, and in the means of acquiring or growing food, applied science was vital.

The following are some examples of Indian Scientific knowledge which could be easily incorporated into any school science curriculum.

A. Extent of Native Indians' Knowledge in the Field of Dyes and Natural Dyeing [11]

Indian women were proficient in the making of vegetable and other dyes. They discovered that alderbark has a unique property of becoming red when exposed to the atmosphere and was an effective permanent dye.

The following question immediately arises:

How did these Indian women become aware of the fact that alder dye had the property of becoming permanently fixed in the material to which it was applied?

One may reasonably conclude from the above fact that the Indian people were aware of some kind of chemical processes of today such as the application of mordant in fixing dyes.

The ancient Indians made little effort to produce ornamentation from colour in the weaving of blankets or other items. Most of the basic colours produced in both woollen and fibre materials were black, yellow, orange and brown.

Black - Sk'ayq (Halkomelem Language - Chilliwack area) was produced by the boiling of hemlock or birch bark with mud containing iron. If an iron pot was used for boiling, the mud was usually left out.

Yellow - *Skwiy (Halkomelem Language - Chilliwack area) was produced from the yellow lichen (Evernia vulpina). The lichen produces a vivid yellow colour when immersed in water and brought to a boil. The wool was then submerged in the dye bath until the desired colour was attained.

At present, the Salish Indians are producing these colours with modern mordants such as Alum, Chrome and Tin. The primitive mordants used by these people to fix colours were urine, iron and copper.

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[11] Alice Ravenhill, The Native Tribes of British Columbia (Victoria: Charles F. Banfield, 1938) p. 65.

B. Production of Yarn and Thread [12]

The Native Indians displayed extensive scientific knowledge in their use of the natural fauna and flora of the country to satisfy their requirements for food, clothing, and shelter.

Recent scientific research in the area has revealed some interesting information and the older native people of the present day have contributed local details of interest, which illustrate Indian uses of the natural sources in their environment.

The following methods have been taken from Arts and Crafts in Chilliwack[13] (British Columbia).

Mountain Goat's Wool - *SAH-ay (Halkomelem Language)

Originally obtained by the Salish by picking shed wool in the high mountains where the mountain goats spent the summer and shed their old wool. Also obtained from the skins of goats killed for meat. The fresh skin, rolled up with flesh sides together, will, after several days, shed the wool which was plucked off for use in yarn making. The coarse, guard hairs of the fleece were removed. A white chalk-like clay was added to the wool, absorbing the grease and leaving the wool with a tendency for the fibres to cling together. Wool was then spun into a loose length of yarn, which was later attached to a spindle with which the native spun a yarn suitable for the use intended for the wool.

For the warp of the heavy blankets, two of these strands of yarn were spun into one double strand of warp, simply by attaching the ends of two separate pieces of yarn to the spindle. As the spinning proceeds, the yarn is drawn from two balls, each in a separate container. Domestic wool has almost entirely replaced the mountain goat wool, which is now rarely obtainable.

Dog's Hair - * TSAH-ee (Halkomelem Language)

The Salish kept dogs for the purpose of wool gathering. These dogs, among some tribes were recorded to be of a Pomeranian type, mostly white in colour. The Chilliwack tribe had dogs which were similar to a coyote, with a deep, wooly undercoat covered by coarser long hair. The dogs were plucked for their wool. Dog's hair was then spun on the primitive spindle. During the spinning process, when the yarn was to be used for fine garments, the down of water fowl, or the down of the milk weed, or fire weed was often incorporated with it.

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[12] Oliver N. Wells, Salish Weaving - Primitive and Modern (Sardis: Oliver N. Wells, 1969),pp. 4-20

[13] Wells, op. cit, p.7

Cedar Bark - *SLAH (Halkomelem Language)

The bark of the cedar trees which grew so prolifically in the land of the Salish was used in many forms for many uses.

For weaving the inner bark of the trees was used. After the bark of the trees had been stripped from the trees in long ribbons, the inner bark was separated and stripped off.

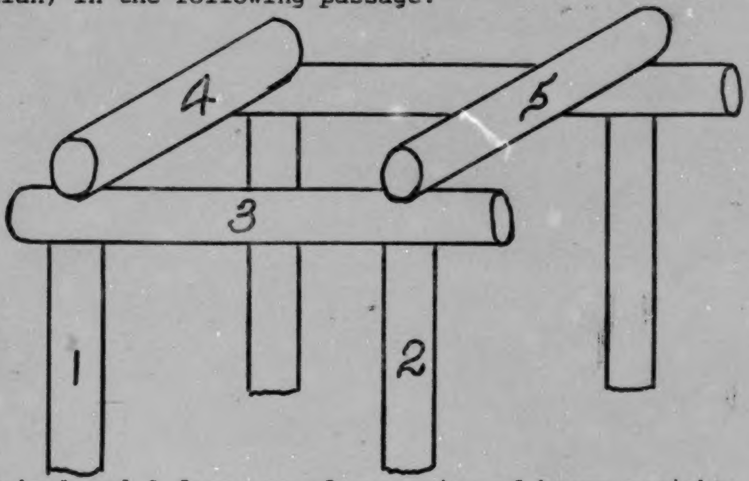
To make it soft and pliable, it was boiled for periods of up to two days. The wide strips were then worked into a soft pliable condition by bending and twisting and rubbing between hands covered with buckskin gloves for their protection. When the bark was soft and pliable strips of desired width would be torn off ready for use in plaiting, or open-work basket weaving. If the work being undertaken required a finely spun material, the bark strips were pounded into shreds and combed into small separated fibres. These were then spun into a fine twine,or heavy cord as required. The bark of the Yellow Cedar was preferred to that of the Red Cedar.

C. West Coast Indian Houses

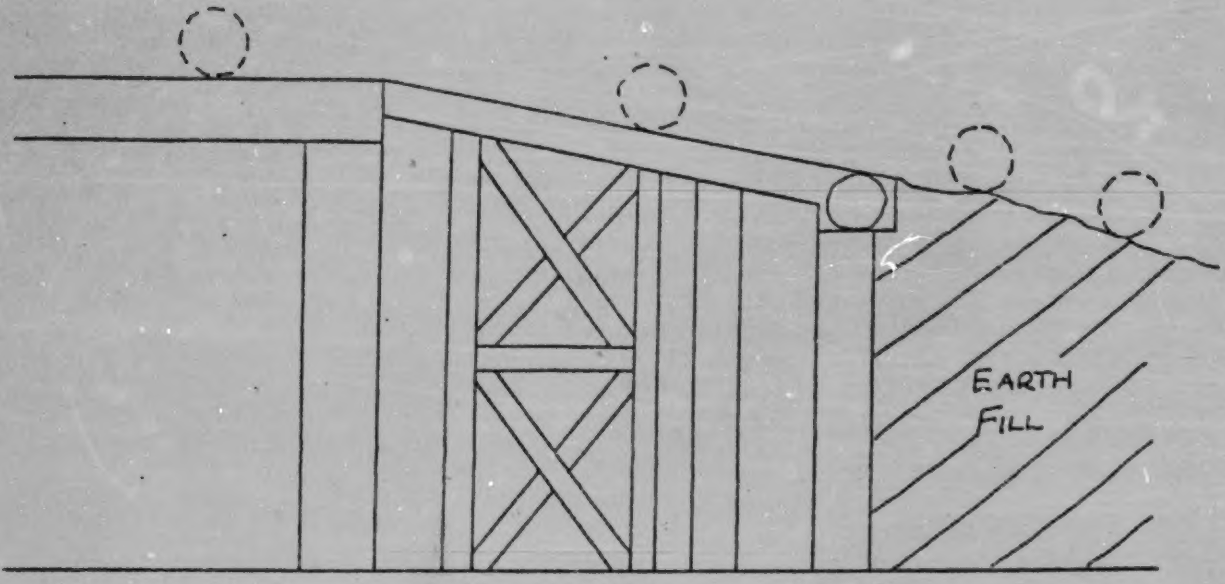
Sophisticated engineering knowledge was obviously required in order to construct the Native Indian large meeting halls and houses.

Possessing neither the terminology nor gadgetry of twentieth century technology, the Native Indians moved gigantic tree trunks which were used to construct the frame work for private dwellings and "long house" meeting places.

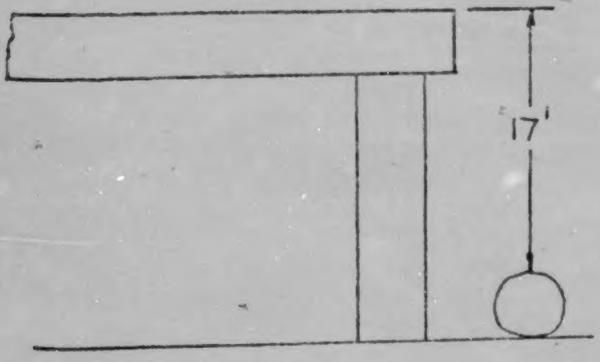
These achievements demonstrate knowledge of the concepts of Lever, Force, Moment and Torque possessed by these Native Indian people. The main superstructure of a Kwakiutl Community House is aptly described by Rev. Ernie Willie (Native Indian) in the following passage:

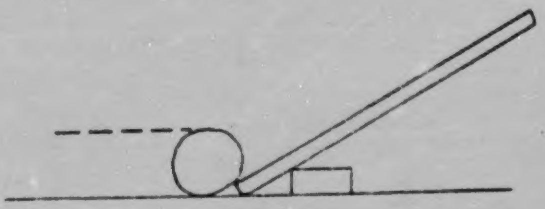


No's 1 and 2 form one of two pairs of heavy upright posts which are 15 ft. in length and spaced 10 ft. apart at the ends of the proposed house. Each pair of posts were united at the top by a horizontal beam (No. 3). The arches thus formed were joined by the two main beams (No's 4 and 5) each approximately 3 ft. to 4 ft. in diameter, 50 to 70 ft. in length, and often weighing as much as 5 to 6 tons. Each beam had to be lifted 17 ft. to the top of horizontal beams directly above the upright posts. This task was accomplished in two different ways.



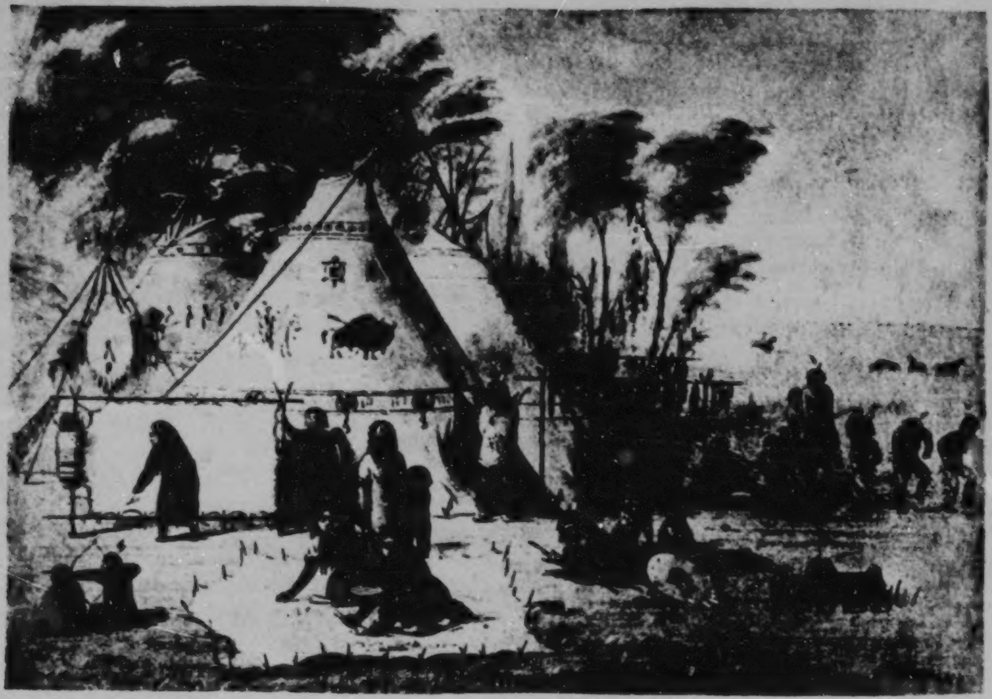
Method I: As in the diagram above, earth was built up to form a ramp extending as far as the secondary support beams, which formed the sides of the house. A ramp of logs, planks leading from the secondary support beams to the top of the supporting posts was constructed so that the main beams could be elevated to their final position. The beams were rolled up the ramp by man power aided only by ropes.





> Method II: The second method made use of leverage and blocking. This tedious procedure was repeated inch by inch until the beam was level with the top of the horizontal beam. It was then rolled into position atop and directly over the post.

D. The Indian Way of Life - A Scientific Study of Environments



The above illustration is a reproduction of a photograph by T.C. Weston, who visited many Indian tribes and left a valuable record of the Ojibwa Indians' mode of living - a way of life that demonstrates their scientific understanding of the environment.

The Indian's keenness of observation[14] is further displayed in his skill in fishing and hunting. Few Europeans have equalled him in these pursuits, except when superior equipment has given them an initial advantage.

Scientific knowledge of the habits of fish was explained by Rev. Ernie Willie (during the author's interview).

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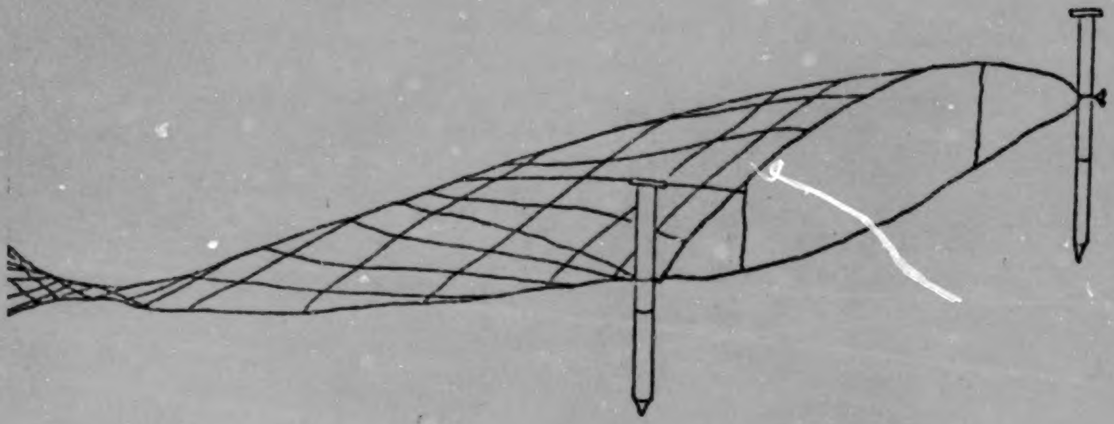
[14] A.E. Pickford, British Columbia Heritage Series (Victoria: Department of Education, Division of Curriculum, Vol. VIII, 1953), p. 20



> A net trap in the shape of a cone was hung between two posts (eight feet apart) driven into the river bed. As the small oolichen (candle fish) rested or slept, they drifted down streams into the traps which had been set at appropriate times. These fish were desired not as food but as a source of oil. The loads of fish were dumped into open pits on the ground covered with cedar boughs and left for approximately two weeks. The decaying fish were then transferred into vats of boiling water. The oil was carefully skimmed and then filtered to give the purest fish oil.
>
> Other fish such as salmon were caught with spears, nets or traps. Much of the fish caught was preserved by drying in order to provide a winter food stock. After the fish had been filleted, they were rocked and placed near the intense heat of burning alderwood in order to seal in flavour and dehydrate the flesh. The longer the dried fish was to be kept before eating, the longer it was smoked. When the time came for the fish to be consumed, water was added and a nourishing meal resulted. The only difference between this food and contemporary dried food stuffs is that the fish was not powdered and packaged.
>
> The dehydration process was also used in the preserving of clams, mussels, berries and meat.

The Indians, keen naturalists, knew the life histories of the animals they hunted, the various stages of their growth and their seasonal movements. Rev. Ernie Willie describes the application of the environmental knowledge.

> My people knew well the habits and characteristics of the animals and fish they hunted on land, sea and air. The Indian knew intimately, for example, the life cycle of the seals. They knew how to locate the underwater entrance to their homes and how to discover their favorite feeding

> places. They knew the life cycles of animals and in what season the game was at its best to kill. The deer, for instance, is at its best just after it comes down from the hill country to the foot hills. It has had a great deal of mineral fed grass in the uplands, and because it is nearing the cold season it is firm and getting fat. In early fall, then, the deer is at its best. It was common knowledge that one does not hunt them in early spring or breeding season, for he might kill the doe while it is bearing or kill the buck when it is yet to perform. Winter is the best time to get bucks, not in the early spring.

Their interest in their environment, and their eagerness to experiment led to their discovery of the medicinal properties of many plants. According to Sproat and other references (Refer to Unit V) the Nootka were well versed in the knowledge of local plants and knew at just what time of the year each plant should be gathered for medicinal properties. Oregon grape, for example, was known as an excellent tonic.[15]

E. Extent of Native Indian's Knowledge in the Field of Pure Sciences and Medicinal Science [16]

Long before astronomy, physics and meteorology were born the Indians interpreted the phenomena of nature in spiritual terms, projecting their own beliefs into processes they saw at work around them.

As observers of the heavens, they had invented many astronomical devices. For their solar observations they used a simple but accurate device known as Inti Tibuayana, which means "resting place of the Sun."

Various astronomers have worked at the problem of determining the alteration of the earth's axis using the ancient astronomical device of Tiahuanacans.

Extent of Indians' knowledge in the field of engineering has been aptly described by Dr. Diamond Jennese:

> We cannot but admire, too, the engineering skill of the Indians, who possessed no machinery of any kind to move the gigantic tree trunks, not even the simple pulley. To place a roof beam in position they levered it up a sloping log whose end rested on top of the pillars; and to erect a house post or totem pole they planked one side of the excavation, levelled off the other side, and raised the top of the pole with levers and supporting crib work until the butt slid gently into its hole.[17]

The above description of the Indian's competence in the field of engineering is exemplified in the following photograph by G.M. Dawson of the Haida Indian village at Skidgate, Queen Charlotte Islands, B.C. The following demonstrates the knowledge in the concept of second and third dimension:

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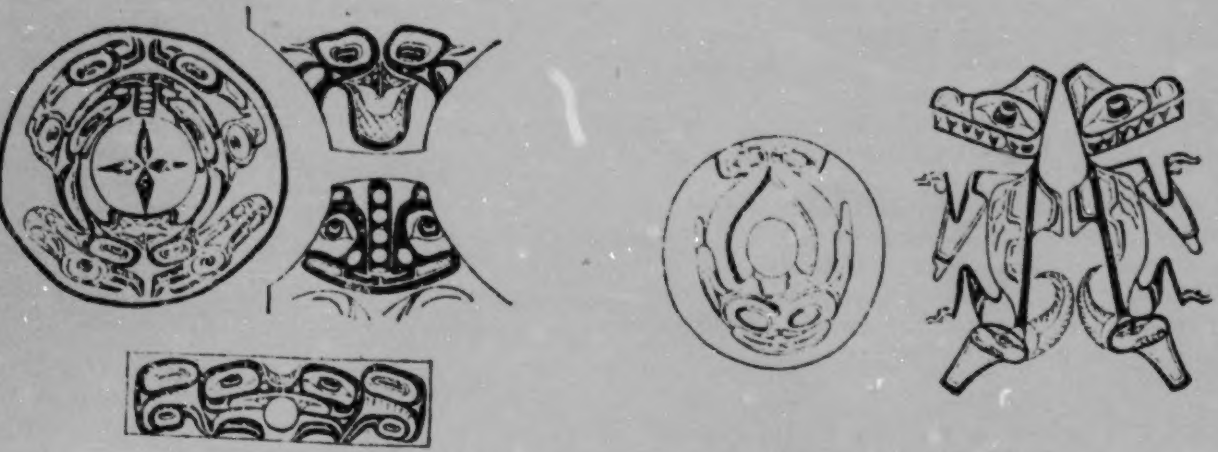
[15] Diamond Jennese, the Indians of Canada (Ottawa: National Museum of Canada, Anthropological Series No. XV, 1955) P. 53

[16] Diamond Jennese, the Indians of Canada (Ottawa: National Museum of Canada, Anthropological Series No. 15, 1958

[17] Ibid, p. 96



In the field of medicine the Native Indians were advanced. They were aware of the medicinal properties and effects of many plants. They were familiar with cocaine (from coca plant of Peru), quinine and calisya. Long before Columbus discovered America the Indians cultivated Sarsaparilla, Impechuane, Rhubarb, Wintergreen and Sassafras (sources of salicylic acid and aspirin) and used natural compounds derived from these plants.

F. Extent of Indians' Knowledge in the Applications of Scientific Principles in Daily Life

The Indians were aware of the scientific principles that sound travels and can pass through the solid phase. To hear sound from a distance they bent down and pressed their ears against the ground and listened.

In shooting arrows the Indians used the same scientific principle that we use today in building "tail fins" on aeroplanes to make the plane fly in a straight line. They used feathers at the end of the arrow to keep it in a straight line.[18]

As there is a lack of written material regarding their achievements it has been very difficult to obtain the above information. Local Indians have been very helpful in my efforts to gather information.

In the opinion of this author, the science teacher should be familiar with the Native Indian scientific culture before making correlations with the contemporary scientific concepts.

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[18] Tillie S. Pine, The Indians Knew (New York: McGraw Hill, 1957), pp. 5-20.

However, for the convenience of the science teacher, some examples of Scientific principles taught in our high schools are provided with reference to the Native Indian Culture.

TOPICS IN SCIENCE	CORRELATION WITH THE NATIVE INDIAN CULTURE
(a) Concept of observation, generalization and scientific attitude.	(a) (i) Indian, keen naturalists knew entire life histories of the animals - how they hunted, their various stages of development and their seasonal movements. (ii) The Indian's keenness of observation is further displayed in his skill in fishing and hunting.
(b) Concept of Lever, Force, Momentum and Torque.	(b) Sophisticated knowledge of these concepts was obviously needed in order to construct their large meeting halls or long houses.
(c) Electroplating	(c) From the tombs and graves at Chan Chan and elsewhere within the Chimu Area have come many articles of copper, plated with silver and gold.
(d) Spectrum	(d) This concept can be correlated with their practice in the use of colours.
(e) Invention of Drugs	(e) Many efficacious and indispensable medicines and drugs are of American origin and were widely gathered and used by the Indians of North, South and Central America, many centuries before the conquest; e.g. - cocaine (from the coca plant of Peru), quinine.

CHAPTER IV

Suggestions to Science Teachers and Prospective Teachers

Science teachers are aware that most of the Native Indian students are not interested in science.

In order to remedy this condition one must first establish the causes. Is it the science teachers, or the Native Indian students, or the present system of education?

In the opinion of this author, the fault lies partly with science teachers, the system of education, and also with the Native Indian students for their negative attitude to the study of science.

The present faulty system of education has been discussed in Chapter I of this project.

Many science teachers have been at fault because they have endorsed and practised only conventional and often reactionary methods of teaching and learning. Furthermore, that these students need individual recognition and attention is quite apparent. As illustrated by the responses to the questionnaire,[19] the achievement of this ideal can be realized through the establishment of personal relationships and understanding with the Native students.

Following are questions to science teachers and prospective teachers as to how the teaching of science might be made meaningful to the Native Indian students. It should be kept in mind that these suggestions are not meant to be prescriptive nor are they necessarily applicable in all situations.

A. Correlating Science With Native Indian Culture

The subject matter must be linked to the understanding that the child already possesses and to his life in general.

In the average school, the majority of students come from backgrounds similar to that of the teacher. The teacher is thus in a position to interpret and project ideas to the students from a common cultural tradition. Problems arise when a student does not share the common life orientation. In order to overcome problems, the western concept of science should be introduced with reference to their culture. This approach might encourage Native Indian students to take pride in their own scientific culture. However, for the convenience of the science teacher, some of the examples of the concept of high school science are provided in Chapter III of this project.

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[19] Kalra, op. cit. pp. 13-61

B. Developing Pride in Indian Scientific Culture in the Science Class

The most important thing a science teacher can do is to develop pride in the Indian Scientific Culture. Also it is necessary for a science teacher to believe basically in the competence of the Indian students with whom he works. The teacher must stress their achievements in science. There are many achievements in the fields of other sciences such as Agriculture, Engineering and Astronomy which have been suggested in Chapter III that can be discussed in an integrated science class. Therefore, a science teacher who is teaching in an integrated class needs a knowledge of the rich Indian scientific culture.

C. Some Practical Suggestions for Science Teachers to Use to Develop Pride In Rich Scientific Indian Heritage

(i) The science teacher should become acquainted with the scientifically rich culture of the Indian students in his class. This will cultivate better understanding and rapport.

(ii) The science classroom should have many displays of all aspects of Indian scientific achievement. For example, pictorial representations of scientific elements from their way of life should be displayed.

(iii) The science teachers should discuss the facets of the Indian scientific culture which appear to be superior to those of the dominant culture; for example, Indians excelled in fishing and hunting. Their knowledge about animal life was very close to perfection.

(iv) The science teacher should invite elders of the tribe to visit the classroom and display their customs, crafts and dyeing techniques.

(v) The science teacher should try to correlate contemporary scientific principles with the Native Indian scientific achievements.

(vi) The science teacher should encourage Indian students to form a social unit or science club. In the assemblies Indian and non-Indian students could investigate and discuss together the customs, traditions and scientific know-how of the North American Indian people.

(vii) The science teachers should also mention examples of the Native Indians who have been quite successful in their lives and have graduated from the present school system, in order to overcome the prevailing idea that success in the white society is not possible. Some of the biographies of the successful Native Indians are found in Appendix II.

D. Compatible Relationships With Students

Teachers should form compatible relationships with these students in order in or to illustrate value and instill confidence in the school and in themselves.

Interesting facts lie behind the statistics. One, for example, is the students' almost universal definition of what makes a good teacher.

> He's young . . . has a sense of humour . . . listens and understands . . . doesn't just go by the book . . . encourages discussion and participation . . . treats us like grown ups . . . gives us responsibility . . . always listens and is free and open with us . . . is interested in us and thinks like a kid.[20]

Pilot studies undertaken in the Hawthorn report[21] indicate that Indian students stayed home from school because they were "afraid of teachers." They "did not want to be ridiculed" and they "just didn't like the school." When asked what they feared, students responded that they feared being brought to the attention of the class or yelled at.

In the opinion of this author the science teachers must realize that an Indian student is not to be classified with other minority groups that are in Canada. The Indian did not come to Canada to find a new way of life.

E. Academic Games in Science Teaching

A student's interest is aroused only when he sees a real use in what he is studying and when it satisfies some felt need and provides some value he accepts.

Accordingly, teachers must provide the environment which affords both experiences desired by the student, as well as a basis for the formal educational goals of the school.

To motivate these students, an activity is required that takes them out of the classroom atmosphere, and which seems to them, at least, to be a non-school activity.

The Native Indians (Bella Coola, Salish, Nootka, Haida, Kwakiutl, Carrier, Chilcotin, Kootenay) like all students, played a number of games. Guessing was the distinguishing feature of the games which were played with bone sticks. "Chemical Charade" and "Chemical Password" are two guessing games that the author has successfully introduced into his Chemistry classes. Chemical Charade is a game in which the students try to guess the right element, compound or substance acted out by an actor designated from the class. In some way it resembles LEHAL, the Native Indian past time in which the opponent is expected to guess the location of certain hidden sticks.

F. Field Trips

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[20] Louis Harris, "What People Think About Their High Schools", Life, (Chicago: Time Inc.) May 1969, Vol. 66, P. 130.

[21] Hawthorn, Op. Cit., p. 136

As illustrated in the evaluation questionnaires,[22] the Native Indian students are in favour of having more field trips in the science course.

In the opinion of this author, these field trips, if handled skillfully, are very effective in making science subjects real and interesting.

In order to achieve any constructive information from these field trips, the activities should be thoroughly planned and correlated with the course content or study unit. Before the field trip, the students should be told the definite purpose of the field trip. After the completion of the field trip, a comprehensive discussion should be held in order to make the experiences and activities of the field trip more meaningful to the students.

G. Experimental Research and Methodology in Public Schools

A continuous research program concerning the problems of the science teaching of Indian students in public schools should be established. Frequently, financial grants should be provided to the science teachers who are engaged in this research.

H. Special Training for Science Teachers

Special training for science teachers working in integrated schools should be provided in order to familiarize them with the Indian cultural background and the psychological background of these students. Furthermore, the Indian Affairs Branch should encourage the training of competent Indian teachers by offering them financial assistance.

I. Linkage With the Future

To provide a meaningful link between the science education of the Indian child and his life needs, there must be a restructuring of employment opportunities so that Native Indian students can find a self satisfying place in society.

Knowing that the attainment of a high school diploma leads, more often than not, to menial "dead end" jobs, certainly offers little in the way of incentive in school. Indian students with the impression that they are "no-body" and functioning in "no-place" we should be providing a learning experience which gives them a sense of contribution and personal worth, hope for the future, and a certainty that they have a place in the economic and social life of the country.[23]

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[22] Kalra, Op. Cit., pp. 13-61

[23] Educational Change: Why-How For Whom: From Speeches of Dr. Arthur Pearle, Department of Education, University of Oregon, Oregon, U.S.A.

J. Linkage With the Past

Indian and non-Indian children have different psychological backgrounds, of which a science teacher must be fully aware.[24]

The following are some of the major differences between an Indian and non-Indian child.

		Indian	Non-Indian
I.	(a)	The control by parents is minimum	Control by parents is maximum
	(b)	Minimum feedback is available from adults	Maximum feedback is available from adults.
II.	(a)	Child is allowed to select and pursue experiences which interest him.	Experiences are too often selected by parents.
	(b)	Life is not time orientated.	Life schedule is rigid and time organized, e.g., bedtime and suppertime.
	(c)	Broken homes and unstable family background are common.	Family life is usually stable

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[24] Hawthorn, Op. Cit., pp. 112-116

CHAPTER V

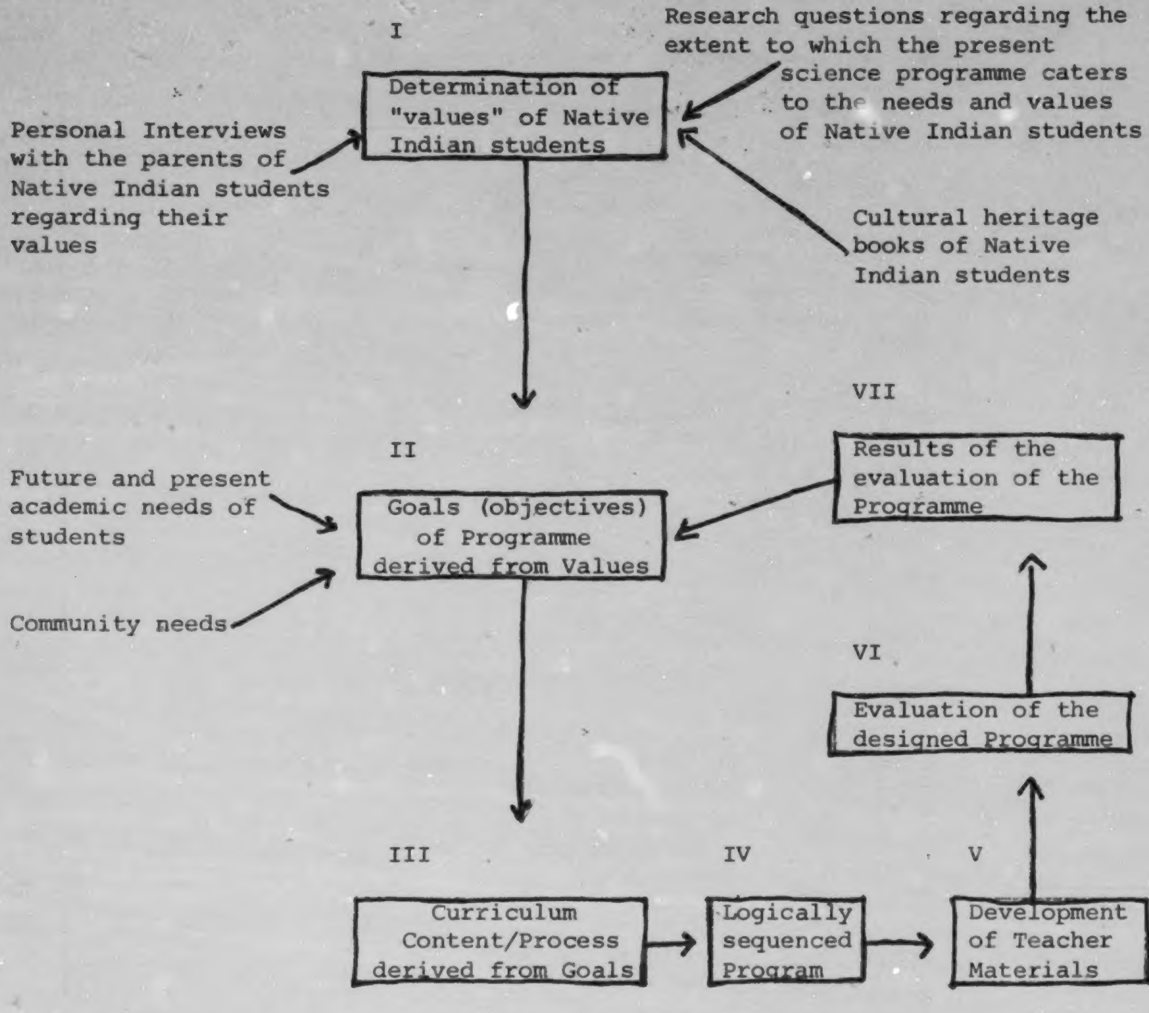
Development of a Model of the Process Used To Develop Science Curriculum Material For Native Indian Students

As explained earlier, the new science curricula has not really approached the problem of teaching science to Native Indian students. It is unlikely that any single curriculum in science will meet the needs of all Native Indian students.

What is needed is the development of a model of the process used to develop science curriculum materials which are responsive to the needs of our Native Indian students.

Thus, the author in this chapter, proposes a model of the process for the curriculum development in science education for Native Indian students.

Schematic Representation of a Model of the Process Used to Develop Science Curriculum Materials for Native Indian Students


I
Determination of "values" of Native Indian students
Personal Interviews with the parents of Native Indian students regarding their values
Research questions regarding the extent to which the present science programme caters to the needs and values of Native Indian students
Cultural heritage books of Native Indian students
II
Goals (objectives) of Programme derived from Values
Future and present academic needs of students
Community needs
VII
Results of the evaluation of the Programme
VI
Evaluation of the designed Programme
III
Curriculum Content/Process derived from Goals
IV
Logically sequenced Program
V
Development of Teacher Materials

Step I: Methods Used in Determining "Values" of the Native Indian Students

(a) Research Questions

In order to develop the proposed program in science education for the Native Indian students, answers to the following research questions were sought:

(i) To what extent does the present course content in science relate to everyday needs of the Native Indian people?

(ii) Is the present course content in science related to the cultural values and heritage of the Native Indian people?

(iii) To what extent does the present course content in science cater to the future needs of the Native Indian students?

To accomplish this, an evaluation questionnaire was administered to the Native Indian students (1970-71) in the high schools of British Columbia.[25] Response to the evaluation questionnaire by the Native Indian students revealed significant need of a new science program which caters to the needs of Native Indian community and is also based on the cultural values of the Native Indian people.

(b) Personal Interviews with Native Indian students residing on and and outside reserves (February 2, 1973)

In order to validate the responses made by the students, twenty five personal interviews with the students participating in the above activity, were conducted in the months of April - June, 1971 by the writer.

(c) Discussion with the educated persons of the Indian community especially from lower mainland (British Columbia).

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Step II: Goals or Objectives of the Program

A philosophy of teaching science consists of aims and objectives of teaching in general and of science teaching in particular. In order for a science teacher to impart meaningful science education to the Native Indian students, a background in their "Cultural Heritage" and "Values" in general is needed. Thus, the objectives of the proposed programs are derived from the "Values" what our culturally different students accept. However, other factors (such as community needs, availability of the materials, library and lab tools and knowledge of the basic concepts in the discipline of science) are also to be taken into consideration for the development of the proposed science program.

Step III: Content/Process

The course content in the proposed science program for the Native Indian students is thus determined by the Steps I and II.

The writer's research indicates that a totally new system of science education is needed that will enable young Native Indian students to develop skills and acquire knowledge which has a high probability of producing a better understanding of their environment and which will make possible for the students own acquaintance with the process of discovery of knowledge. Such a curriculum in science would not lay emphasis on theoretical and unrelated scientific principles to the students' daily life but rather the application of knowledge to everyday life for the improvement of living conditions. The curriculum should also have some real intellectual meaning and demand thinking on the part of the students, especially for the more able students.

Thus, the writer in this project proposes a program entitled, "Turn-on Science Program for Native Indian students with a Focus on Values" which is a terminal course in science so that our Native Indian students may gain a better understanding of the part science plays in their everyday life and learn about its application to the daily life. Another unique feature in this program is an illustration of Native Indian scientific achievements. The writer proposes to correlate some of the above contributions with the science concepts taught in schools. Hopefully, our Native Indian students may develop pride in their scientifically rich heritage, develop an interest in learning to understand the world in which they live through an understanding of science, and achieve satisfaction from success.

Step IV: Logically Sequenced Program (Organization of the Proposed Program)

Listed below are some of the guiding principles which will be followed in the development of the proposed program.[26]

(1) The curriculum shall be organized into units each of which shall be related to some significant aspect of the environment.

(2) The unit will be essentially a major problem of everyday life to which science may contribute an intelligent basis for human adjustment.

(3) Each unit shall include only a few principles of generalizations of science.

(4) The organization, in part at least, shall be in the form of problems or projects to ensure education in problem solving, which is the nature of science.

(5) The distribution of time and emphasis to various units shall be determined by the total functional, social value of the units, its "teachability" and "learnability", the teacher's and pupils' interest in

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[26] National Society for the Study of Education: Thirty-first year book, Part I, Bloomington, Illinois: Public School Publishing Co. 1932 p. 209

the unit, the local significance of the unit, and its value to other units of the course.

(6) The laboratory work shall be included as an integral part of the problem solving and shall, therefore have the characteristics of experience and should de-emphasize illustrative or conformatory work.

(7) The organization of the course shall be such that it will lead to the attainment of immediate and ultimate objectives.

Step V:

Teacher materials will be developed and distributed to a randomly selected teachers (60) throughout the province of British Columbia.

Step VI and VII:

The writer intends to include evaluation questionnaire for the students and the teachers regarding the relative strengths and weaknesses of the proposed science program, its operation in existing facilities and recommendations for change. Also, a random selection of teachers and students will be made for in-depth interviews. Additions or subtractions will be made with this program with reference to the above suggestions from the students and teachers involved in this program.

CHAPTER VI

Overview of the Turn-On Science Program
For Native Indian Students

An attempt has been made to design the above science program for junior high school students who are not keenly interested in science and are potential drop-outs. The writer's experience suggests that the majority of our Native Indian students are in this category.

In order to arouse interest in science among those uninterested students, technology (especially Native Indian contributions)is used as a vehicle. Hopefully, Native Indian students may develop pride in their scientifically rich heritage, develop an interest in learning to understand the world in which they live through an understanding of technology, and consequently achieve satisfaction from success.

In this program, Unit I (Our Technical World), Unit II (Environmental Science) and Unit III (Psychic Drugs, Alcohol and You) have been treated extensively, as an example of how science curriculum may be constructed.

These units utilize only the materials concerning Native Indians which the teacher can easily secure and is designed to provide useful scientific learning. These units are in the form of a teacher's handbook.

Unit IV is presented as a resource material concerning Native Indian scientific knowledge.

Unit V (Plants and Native Peoples in British Columbia) may be treated as a resource material concerning Native Indian knowledge of plants.

Unit VI (Suggested Activities in Physical Sciences) is composed of some activities in the physical sciences with some directions for the teacher.

Unit VII (Science is Fun) is composed of some activities. Some students have found these activities very interesting.

The organization is partly in the form of problems and the laboratory work is included as an integral part of the problem. Rushing through a pre-determined mass of material in order to "cover the course" must be avoided. Quality of work should be given more consideration than quantity.

UNIT I

OUR TECHNICAL WORLD

The focus on "technologist" as opposed to "scientist" or "chemist" is not the result of confusion. The intent is to create interest in, and appreciation of science by showing science at work in the community.

By approaching scientific principles and methods by way of technology the chances of motivating uninterested students are increased. The emphasis is on practice, not abstraction or theory.

UNIT I

Our Technical World

CONTENT

A. General Instructional Suggestions

B. The Work of the Technologist

C. The World Around Us

D. The Contributions of North American Indian People in Our Technical World.

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GENERAL INSTRUCTIONAL SUGGESTIONS

(1) The teacher should make use of all local community resources (e.g.; Native Indian people, local pharmacist, doctor, lab technician, engineer and agriculture inspector) to explain the work of the scientist. For example the students should be asked to bring from their homes some articles (table salt, Native Indian's instruments for making fire; such

as, a hand drill, a pump drill, a fire plough and Native Indian dyes, paints and fishing instruments) involving the applications of science, and discuss these in the class. Field trips to reserves and a city should be arranged. Before the trip, the students should be told to look for examples of applications of science to the daily life.

(2) The answer to any question should not be made readily available to the student. The students should be encouraged to think and struggle with the question. If the question is very difficult, the teacher should help students find the solution.

STATEMENT OF GENERAL OBJECTIVES

(1) The student should demonstrate that he understands the work of the technologist.

(2) The student should demonstrate that he understands how the work of the technologist affects him, his family and the community.

(3) The student should demonstrate that he is familiar with the methods and tools of the technologist.

(4) The student should demonstrate that he is familiar with his heritage in the area of related sciences.

Specific Objectives

The student should demonstrate that he understands the work of the technologist:

(a) in industry
(b) in the area of consumer goods
(c) in protecting the environment
(d) in agriculture
(e) extending the range of human knowledge
(f) protecting human and animal life
(g) in the analysis of Chemical substances

Suggestions to the Teacher in Implementing Objective (1)

The successful teaching of this or any course depends on the abilities and resourcefulness of the science teacher.

The purpose of the teaching suggestions is not to lay down hard and fast rules for the achievement of the above objective but to act as a guide. Thus, the science teacher should feel free to use any material which is not listed in this unit in order to make the students understand the work of the technologist. However, the following suggestions should be helpful to the science teacher who is trying to achieve the above objective.

UNIT I - OUR TECHNICAL WORLD

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem 1-A		Activity No. 1	
What is the work of the technologist who uses scientific discoveries?	The following are some of the suggested local resources in the community: (a) Native Indian resource persons (b) Native Indian people who have graduated from the high school system.	Invite the Native Indian people to explain the Indian way of life which is a scientific study of environments. The teacher should stress that Indians keenness of observation is displayed by their skill in fishing and hunting. Mention that few Europeans have equalled them in these pursuits except when superior equipment was given to them as an initial advantage.	Have the students write a report on the Indian way of life.
	(c) Indian methods of making fire: (i) Lumps of iron pyrites (ii) A fire-plough (iii) A hand-drill (iv) A pump drill	The teacher should explain the Indian methods of making fire which involves applications of various scientific principles	

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem 1-A (cont'd.)	Some students may bring the fact that 30 years ago Tuberculosis used to be considered a fatal disease. Chemists discovered a medicine known as PAS (Para-amino salicylic acid) and Tuberculosis is no longer considered a fatal disease.	Activity No. II Have the students investigate by inquiring at home and from local resources some articles made by scientists of the present. Select something unknown, say, 30 years ago.	
		Activity No. III The teacher should have a round table conference and lead a discussion about the information obtained by the students from Activity No. I and II. The teacher should discuss that many animals (cows, horses) became victims of diseases which were then incurable resulting in the death of the animal. This was a great financial set back for an average person, but most of the common diseases of animals which were once fatal can now be easily cured by modern medicines.	The students will be evaluated according to their participation in the round table conference.

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem 1-A (cont'd.)	Veterinary Doctor	If possible, a lecture from a veterinary doctor would be quite informative. The teacher should also discuss the contributions of science in textiles, vitamins, nutrients and insecticides.	
	Nylon Plastic Dyes D.D.T.	Activity No. IV Have the students study articles and products (e.g., nylon, plastic, dyes, D.D.T., etc.) made by scientists and discuss the work of technologists in the making of these products. The teacher should also discuss the contributions of North American Indians in the realm of Native dyes, natural dyeing and production of yarn.	The students will be evaluated on the basis of their participation in the class.
		Activity No. V Field Trip No. I Arrange a field trip to a factory near the community (if possible) and discuss the work of the technologist. Also, if possible, arrange a trip to the Indian reserve where the Native Indian people are producing dyes. For example, the Salish	

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem 1-A (cont'd.)		Indians are producing these dyes with modern mordants such as Alum, Chrome and Tin.	
		Activity No. VI The teacher should arrange a visit to the local health unit. A member of the local health unit may be requested to speak on insecticides and chemicals used in water purification and sewage. Pharmacist can elaborate on the work of the technologist by giving some examples of modern medecines.	
		After the visit to the local health unit, the teacher should discuss the role of technologists in activities IV and V.	The students will be evaluated according to their participation in the discussion
		Activity No. VII The teacher can request some of the major petroleum companies (e.g. Texaco, Esso, Shell, Gulf Oil Co.) to show a film on the exploration and refining of crude oil	The students are asked to write a short report on the film, emphasizing

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem I-A (cont'd.)		emphasizing the work of the technologists. If the film cannot be arranged, the teacher can write to these organizations for pictures illustrating the refining of petroleum and the work of the technologist.	the work of the technologist in the refining of petroleum.
		After the film showing, the teacher should have a round table conference and discuss the role of the technologist in the petroleum industry.	The students will be evaluated on the basis of their participation in the round table conference.
		Demonstration	
	- Distillation flask - stand - crude oil - Bunsen burner	The teacher should carry out distillation of a mixture of crude oil.	The students are required to record the observations in their laboratory note book and discuss the above observations in the class.
		Activity No. VIII	
		Have the students discuss each film and visit (refer to Activity IV, V and VI), explaining the work of the technologist in each of the above activities, thus	The students are asked to submit a report on each film, emphasizing the work of the technologist. The student should be

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem 1-A (cont'd.)		reviewing the work of the technologist in industry. Activity No. IX (Practical Applications of Chemistry in our Daily Life) Demonstration I: Preparation of Soap. Soap is made by boiling together either sodium or potassium hydroxide and some vegetable oil or animal fat (olive oil, palm oil or cotton seed oil.) $\text{Alkali} + \text{fat} \longrightarrow \begin{array}{c}\text{soap}\\+\\\text{glycerine}\end{array}$ Lab Instructions	able to list facts and concepts learned.
	80 grams of cotton seed oil 20 grams of lye Beaker (1000 ml) Water Thermometer Stirring rod Bunsen burner	Melt about 80 grams of cotton seed oil. Dissolve 20 grams of lye in 40 ml of water. Pour the hot oil into the lye solution a little at a time stirring constantly and keeping the temperature below the boiling point. Heat for half an hour, then cool. Remove the cake of soap and test its action in water. Demonstration II: Preparation of toothpaste	

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem 1-A (cont'd.)		and powder.	
		Method I	
	Table Salt Baking Soda Beaker	An inexpensive but effective tooth powder can be prepared by mixing 1 part by weight of powdered table salt and 2 parts of baking soda. The salt serves as an astringent and the bicarbonate reacts with food particles in the mouth.	The students will be evaluated on the basis of their answers to the following question: What ingredient is used in toothpast for the purpose of (a) neutralizing mouth acids? (b) providing a pleasant after taste?
		Method II	
	Powdered Chalk Sugar Sodium Carbonate Beaker	Another powder can be made by mixing thoroughly 4 grams of powdered chalk, 1 gram of powdered sugar and 1 gram of Na_2CO_3	
		Method III	
		Combine 125 grams of precipitated chalk $CaCO_3$ (available at drugstore at low cost), 95 grams of magnesium carbonate	The students are asked to submit a short report giving the major ingredients and the

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem 1-A (cont'd.)		(a polishing material), 30 grams of powdered sugar and 30 grams of powdered white soap. Mix these thoroughly so that the powders are well distributed. If a flavour is desired, add about 5 drops of peppermint. Add equal parts of glycerine and water to the powder until a paste of a familiar consistency results.	methods of preparation of the following consumer goods: (a) soap (b) toothpaste
The technologist is important in manufacturing consumer goods.		Activity No. X It is quite feasible to have a film on the manufacture of consumer goods by requesting some of the major manufacturers. For example, Proctor & Gambles, Lever Brothers have films about their products in daily use for publicity. The above activities demonstrate the work of the applied chemist in the area of consumer goods.	
The technologist helps make the soil more productive.	Agriculture Inspector	Activity No. XI Invite an agriculture inspector to give a lecture on the scientific farming	

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem 1-A (cont'd.)		which requires a knowledge of the chemistry of soils and fertilizers. Some practical demonstrations may be given by the speaker on the use of fertilizer.	
		The teacher should elaborate the contributions of the chemist in the manufacture of fertilizers.	
	Two plants Fertilizer	Activity No. XII	
		Have the students grow two plants under similar conditions, one with fertilizer and the other without fertilizer.	The students will be evaluated from their reports explaining the role of fertilizer in growth of plants.
		Ask the students to submit a short report explaining the difference in the rate of growth of these plants.	
		Tell the students the role of technology in extneding the range of human knowledge.	
		Activity No. XIII	
		To make raisins in the science lab	

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem 1-A (cont'd.)	Grapes Pan Paper Towel Cloth or Screen Tray	Method I: Making Raisins by Drying in the Sun Have the students weigh the grapes (approx. 150 grams). Put the grapes in the pan or bowl of water and wash them thoroughly but gently without bruising the grapes. Dry the grapes by blotting with a paper towel. Remove the grapes from the stem and put a single layer of grapes in a tray. Cover the tray with some clean cloth to avoid any impurities. Put the tray containing grapes in the sunshine (by a window) to dry, away from dirt and dust. Let the air blow freely (not windy but free circulation) over the grapes. After 48 - 72 hours find out if the grapes are dry by squeezing them. If there is some wetness wait for another 24 hours. When the grapes are dry take them off the tray and weigh them. Ask the students to record the following data in their note books: (1) Weight of grapes before drying = ... grams	

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem 1-A (cont'd.)		(2) Weight of grapes after drying = ...grams. (3) Weight of moisture lost (subtract (1) from (2)) = ...	
What is dehydration?		Keep the dried grapes in a glass container. The teacher should introduce the concept of dehydration from the above activity	Have the students write an operational definition of dehydration.
		Science has entered our daily lives so fully that reference to scientific matters in newspapers, magazines and in conversation are common. The teacher should also emphasize cultural values of science since a well educated person is one who has a general acquaintance with many fields of knowledge. The students should be able to understand what is written in science books, magazines and newspapers.	The students are asked to make a collection of clippings from their daily newspaper which deal with scientific research, industries, or new products. Students will be evaluated according to the significance and number of clippings which deal with science.
The technologist improves the quality of human and animal life.		Activity No. XIV The teacher may show the films concerning the manufacture of	The students are asked to write a report on

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem 1-A (cont'd.)		drugs and their use in the protection of human and animal life. The above films can be easily obtained from the pharmaceutical firms on request. After the film show, the teacher should arrange a round table conference and discuss the benefits of medicines in human and animal life.	the benefits of medicines in human and animal life.
The technologist helps keep us healthy but also creates a problem of pollution		Activity No. XV Demonstration III	
Note: Students must show they understand one or more methods of purifying water and importance of same.		Distill some drinkable water with impurities and tell the students that there are various methods of purification of water. One of the most common used in the Chemical lab is distillation. Mention some of the methods of making water potable. For example: Sedimentation, coagulation, filteration, aeration.	The students are asked to submit a report on the following project and discuss it in the class: "How the technologist can help us in the protection of our environment." The students will be evaluated

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem 1-A (cont'd.)		Tell the students that those methods will be discussed in detail in Unit II.	according to their participation in class
		The teacher should also discuss water and air pollution around the community and the world with the aid of pictures illustrating the problems of water and air pollution and how we can overcome them. Tell the students that the problem of pollution will be discussed in a later unit (Unit II).	
		Demonstration	
		The teacher should demonstrate the problem of air pollution by the actual burning of sulphur and carbon resulting in the formation of SO_2 and CO_2.	The students are asked to submit a report on the problem of air pollution in the community.
		Tell the students that the problem of water pollution will be dealt with in detail in Unit II.	

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem 1-A (cont'd.) The technologist analyses the chemical substances.	Mercuric oxide Bunsen Burner Test tube	Activity No. XIV Heat mercuric oxide to illustrate analysis. Have the students state observations after the demonstration. The teacher should state the methods by which a chemist determines the composition of matter.	The students are required to write observations in their lab note books and discuss them in class.
	Beaker Water Sulfuric acid Electrodes Electric source	Activity No. XV Pass an electric current through acidified water to illustrate chemical composition of water. Test the presence of hydrogen and oxygen by glowing splinter.	The students are required to write observations in their lab notebook and discuss their observations in the class.
	Zinc Hydrochloric acid	Activity No. XVI Mix Zinc and hydrochloric acid in a test tube. Test the presence of hydrogen by glowing splinter and evaporate zinc chloride solution.	Same as above.

Evaluation of the first objective

In order to evaluate the first objective as a whole, the teacher should evaluate each of the activities as suggested and grade the student according to the extent of his comprehension and appreciation of the work of the technologist.

The following is a word of caution in assessing these criteria:

The teacher should make sure that the student has not merely memorized facts but understands the work of the technologist. Three simple methods for determining the student's ability are mentioned below.

(1) Class participation in discussions and field trips, variety and quality of questions and sincere efforts to find a solution of the problem.

(2) Reports

(3) Oral Quiz

However, the following two activities might be helpful to the teacher in ascertaining that the students have understood the work of the technologist.

(1) Have one group of students submit a report on industrial science, a second group on agricultural chemistry, a third group of medicinal science and a fourth group on extending the nature of human knowledge. Collect the reports, evaluate them and have students give a panel discussion in class. The purpose of this discussion is to allow students to pursue a field in which they have more interest, and present their findings to the class. After the discussion, each student should write a report on all the aspects of science discussed, emphasizing the role of science as it pertains to him.

(2) Set out, on a table, some articles of daily use. Include some articles which do not involve any application of science. Ask the students to point out those substances which are not developed by scientific processes.

Suggestions to the teacher in Implementing Objective II

(1) The teacher should correlate content with the character of community life. For example, discuss how an understanding of science will make a person a better farmer or a better citizen. The teacher should discuss the value of science in all walks of life.

(2) The teacher should use the investigation approach and encourage the students to participate in the discussion of the applications of science in the daily life.

(3) The teacher should not ridicule any question. Some questions may be irrelevent, or reveal ignorance. These should be dealt with in constructive discussion.

Content	Examples, Apparatus and Materials	Activities	Evaluation
Problem 1-B: What is the world around us made of?	Rock Paper Cloth Water Fertilizers	Activity No. I (a) Set out on a table all the equipment mentioned in the previous column and discuss the contributions of science in the making of these substances.	
		(b) Have the students investigate and describe the applications of science in the surroundings of their own community. Have the students eliminate those substances which are not developed by scientific processes.	The students prepare a list of the substances available at home involving the applications of science and discuss in class.
		Activity No. II	
Science is important in our daily life	Soap Cosmetics Disinfectant Fertilizers	Ask students to describe what life would be without the following substances: soap, toothpowder, cosmetics, disinfectants. The teacher should discuss the many products of a chemical nature which are used in the community life.	The students will be evaluated on the basis of their active participation in class.
		Ask the students to solve the	

Content	Examples, Apparatus and Materials	Activities	Evaluation
Problem 1-B (cont'd.)		following problems by using materials that are the result of chemical technology: (a) to remove spots and stains from the clothes. (b) to extinguish fire. (c) to cure diseases like malaria, typhoid, flu.	
Science helps in understanding our bodies.		The teacher should tell the students that eating is not only one of the most enjoyable activities but also one of the most essential activities for the body's development. The teacher should also explain the importance of a proper and balanced diet in the human body.	
		Provide an example of a balanced diet. The teacher should also discuss the harmful effects of undesirable foods.	The students will be evaluated from their active participation in the discussion and a report about the balanced diet.
		Have the students discuss and make a report about the balanced diet which an	

Content	Examples, Apparatus and Materials	Activities	Evaluation
Problem 1-B (cont'd.)		average person should eat.	
	Pictures of rats or persons showing effects of unbalanced diet.	The teacher should exhibit the pictures of rats or persons eating unbalanced diets, e.g., knock knees, bow legs, anemia.	

Evaluation of Objective II

In order to secure a reliable evaluation of the accomplishments of a pupil in this objective, it is necessary to make assessments of the components of a unit, such as the individual problems in this objective, as mentioned earlier.

The teacher should utilize all evaluation techniques mentioned previously. For example, the teacher should grade students according to the following criteria.

(1) Participation in class discussion

(2) Reports

(3) Oral and written quiz

In addition to the above evaluation procedures, a subjective type of question may be used as the supplementary portion of an objective question. The following example would elucidate the above conviction.

Subjective Type of Question	Objective Type of Question
Write a short essay on the contributions of the technologist in the improvement of community life.	Please use + for true and 0 for false. Chemistry has specific applications in the following aspects of our life activities: (a) Consumer goods (b) Cleanliness (hygienic living) (c) Reducing human sufferings

Furthermore, the teacher should give subjective types of questions in the form of problems where students learn to think.

The following question in the form of a problem would clarify the above statement:

Problem I

It is said that the progress of a community depends upon the changes brought about by the technological discoveries.

Name a few scientific contributions involved in each of the following aspects of your life:

(1) The home

(2) Health

(3) Agriculture

(4) Communication

Problem II

How can we use what we know of science to improve our life?

OBJECTIVE III

The student should become familiar with the methods and tools of the technologist.

Suggestions to the Teacher in Implementing Objective III

(1) The technologist employs an orderly method of thinking known as scientific method. In the opinion of this writer, scientific method as a rote item in this program has little value. Its value should be realized by actually applying it in classroom work (e.g., in experiments, and demonstrations) and by telling the students when scientific method is being used.

(2) The teacher should show all the equipment present in the lab and explain the function of each item.

(3) The teacher should advise the students to make clear and accurate records in their lab note books at the time of their observations. The students should be sent into the lab to investigate the various scientific principles. To much time should not be spent on getting the correct results which gives a false concept of the whole scientific endeavour.

(4) A resourceful teacher can partly overcome the problem of shortage of some laboratory equipment needed in this program by constructing various models in order to illustrate the various scientific principles. For example, the teacher can make the model of a fire extinguisher. The students should be actively involved in the making of these models.

Content	Examples, Apparatus and Materials	Activities	Evaluation
Problem 1-B (cont'd.)		Lab Activities Experiment No. 1: Observation and Laboratory Method Exercise I-A	
	In general, the following observations should be made: Science equipment present in the laboratory. Number of doors, windows and desks.	How well do you observe? Have the students look around the classroom and laboratory. "List eight significant observations and compare your results with those of other students in your class."	The students are required to record the observations in their laboratory note books and discuss the observations in the class.
		Exercise I-B	
	Candle Ruler (for measurement of length, height and diameter of the candle. Tin lid Match box	"What observations can be made on a burning candle?" The teacher should help the students in making observations and inference in the above experimentation.	Same as above
Concept of observation, generalization and scientific attitude.		Have the students define the concept of observation, generalization and scientific attitude in their own words,	The students are required to write the definitions of the concept of observation

Content	Examples, Apparatus and Materials	Activities	Evaluation
Problem 1-B (cont'd.)		from the exercise I-B discussed earlier. The teacher should also point out that the above concepts were utilized by many people 100 - 200 years ago. For example, North American Indian's keenness of observation is displayed in his skill in fishing and hunting. Furthermore, the Indians who are keen naturalists know entire life histories of the animals; how they hunted, their various stages of development and their seasonal movement.	generalization and scientific attitude in their note books.
According to Sproat, the Nootka were well versed in local plants and know at just what time each plant should be gathered for medicinal properties. Oregon grape, for example, was known for its excellent tonic use.		The above examples illustrate that their (Indians) interest in their environment and their eagerness to experiment led to their discovery of the medicinal properties of many plants.	

Content	Examples, Apparatus and Materials	Activities	Evaluation
Problem 1-C		Exercise I-C	
What is a physical change? Any change in matter which does not destroy the identity of a substance, or change its characteristic properties is a physical change. It is a temporary change.	Ice Beaker Bunsen burner	Demonstration Melt ice and boil water to form steam. The teacher should tell the students that in the above example matter has undergone change. Its form may not be the same, but the matter has not lost its identity. Such a change is called a physical change.	
Problem 1-D		Exercise I-D	
What is a chemical change?	Wood Bunsen burner Test tube Zinc Hydrochloric acid	Ask the students to observe a change in the following demonstrations and write it in their note books: (a) Burn wood (b) React zinc with diluted hydrochloric acid in a test tube. Have the students tell the difference between this change and above change. (Refer to Exercise I-C)	The students will be evaluated from their participation in the above demonstration.

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem 1-D (cont'd.) In a chemical change, a new substance with new properties is formed.		The teacher should tell very clearly that in each of these changes the identity of the original substance or substances is lost. These are called chemical changes.	The students will be evaluated from the following question: Which of the following are physical changes and chemical changes? (a) The burning of coal (b) The decay of food (c) Freezing of water (d) Burning of candle
		Exercise I-E	
	Beaker (200 ml) Graduated Cylinder Concentrated H_2SO_4 Potassium dichromate solution Ethanol Thermometer	Demonstration: Preparation of chrome alum crystals. To 100 ml of water in a 200 ml beaker slowly add 9 ml of conc. H_2SO_4 with stirring rod. Add 9 grams of potassium dichromate to the above beaker containing diluted acid and keep stirring till potassium dichromate is dissolved. Now slowly add 10 ml of	

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem 1-D (cont'd.)		ethanol to the above solution. Leave the beaker for a week. Crystals of chrome alum will appear in the bottom of the beaker after a week. Ask the students to write the observations in their note books explaining whether a change taken in the above demonstrations is a physical or a chemical change.	The students will be evaluated from their observations and from their explanation of the change that has taken place.

OBJECTIVE IV

The student should demonstrate that he is familiar with his heritage in the area of related sciences.

We, as science teachers, are aware that our Native Indian students are not interested in science. This writer believes that the contributions of various Native Indian people in our scientific world may be used as a vehicle to arouse some interest in the subject. Thus, the subject matter may be correlated with the heritage of Native students so as to develop pride in their scientifically rich heritage, develop an interest in learning to understand the world in which they live through an understanding of applied sciences (technology) and consequently achieve satisfaction from success.

For the convenience of the science teachers some illustrations of the extent of Native Indian scientific knowledge is found in Chapter III.

UNIT II

Environmental Science

I. CONTENT

A. Three states of water

B. Natural sources of water

C. Water pollution

D. Methods of purification of water

E. Chemical composition of water

F. Physical and chemical change

G. Air pollution

H. Food pollution

I. Oil pollution

II. OBJECTIVES

(1) To impart information to the students on how science can help the people make more healthful and effective use of water and air in the community.'

(2) To familiarize the students with the problem of man made pollution and how to overcome the problem of air and water pollution.

(3) To provide the students with an understanding of the methods used in changing matter from one physical form to another.

III. REFERENCES FOR THE TEACHER

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- H.J. MacDonald, "Through a Glass Darkly - Our Drinking Water Can't be Trusted," Weekend Magazine, (Montreal: The Montreal Standard Publishing Company Ltd.) vol. 23, No. 11, March 17, 1973.

- Frank Morgan, Pollution (Vancouver: Ryerson Press 1970)

- William E. Price and George H. Bruce, Chemistry and Human Affairs (New York: World Book Company, 1949)

- Victor C. Smith and B.B. Vance, Science for Everyday Use (Chicago: L.B. Lippincot Company, 1951)

- Gordon Taylor, The Biological Time Bomb, (New York: Signet Books, 1969)

- Unesco, 700 Science Experiments for Everyone (Garden City N.Y., : Doubleday & Co., 1958)

- Gordon Young, "Pollution - Threat to Mans Only Home", National Geographic (Washington D.C.: National Geographic Society, December, 1970), p. 758

UNIT II

ENVIRONMENTAL SCIENCE

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem II-A:		Demonstration II-A	
In how many physical states does water exist?	Water Flask Condenser Bunsen burner	Demonstrate the three physical states of matter using water (solid state - ice, vapor state - steam, liquid state - water)	The students are asked to note the observations in their notebooks and describe the different states of water.
Problem II-B:			
What are the common sources of water?		Have the students discuss the sources and abundance of water upon the earth's surface.	
Problem II-C:			
How can we demonstrate the phenomenon of evaporation and condensation in our lab?		Discuss the natural formation of rain water. Discuss the phenomenon of evaporation and condensation. Experiment II-1 Introduction to Evaporation and Condensation. Have the students investigate the phenomenon of evaporation from wide mouthed jars and by boiling.	

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem II-C (cont'd.)		Procedure (Instruction for the students)	
		Part 1	
	Wide mouthed bottles Masking tape	(1) Obtain several wide mouthed bottles. Fill the bottles with varying amounts of water. Mark the level of the water in the bottles with masking tape or rubber bands.	
		(2) Place the bottles near window and let them stand.	
		(3) After several hours observe what has happened to the level of water in the bottles. Record these observations in your laboratory note book.	
		(4) Leave the bottles untouched near the window over night.	
		(5) Next day observe what has happened to the water level in the jar. Record these observations in your lab note book.	
		Part II	
	500 Ml beaker Bunsen burner	(1) Obtain a 500 ml beaker. Fill this with 400 ml tap	

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem II-C (cont'd.)	Wire gauze	water. (2) Place the beaker on a ring stand and place a bunsen burner under the ring stand with a wire gauze. Continue heating the water in this manner until it comes to a boil. (3) Let the water boil for about 15 minutes. Observe what has happened to the water level.	The students will be evaluated from the following question: "From your observations, attempt to explain what happened to the water in the jars near the window and in the beaker of boiling water. Use the concept of Evaporation in your explanations.
	1000 ml beaker colour (red or blue) Ice	Part III (1) Obtain a 1000 ml beaker. Fill this 3/4 full with cool tap water. Add several ice cubes to the water. (2) Using a suitable colour, (preferably dark) colour the water in the beaker. (3) After a few minutes feel the outside of the beaker. Note the colour of the water on the outside of the beaker. (The above phenomenon of condensation can also be demonstrated by inverting a	The students will be evaluated from the following question: "From your observations, attempt to explain where the water on the outside of the beaker (in part III) came from. Make reference to "condensation" and "water vapour. Additional Questions Attempt to explain in the terms of

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem II-C:		jar over the burning candle)	evaporation condensation, what becomes of the water in our oceans, rivers, lakes and atmosphere. Try to devise a cycle to explain the processes involved. (refer to diagram 1 - Water Cycles)

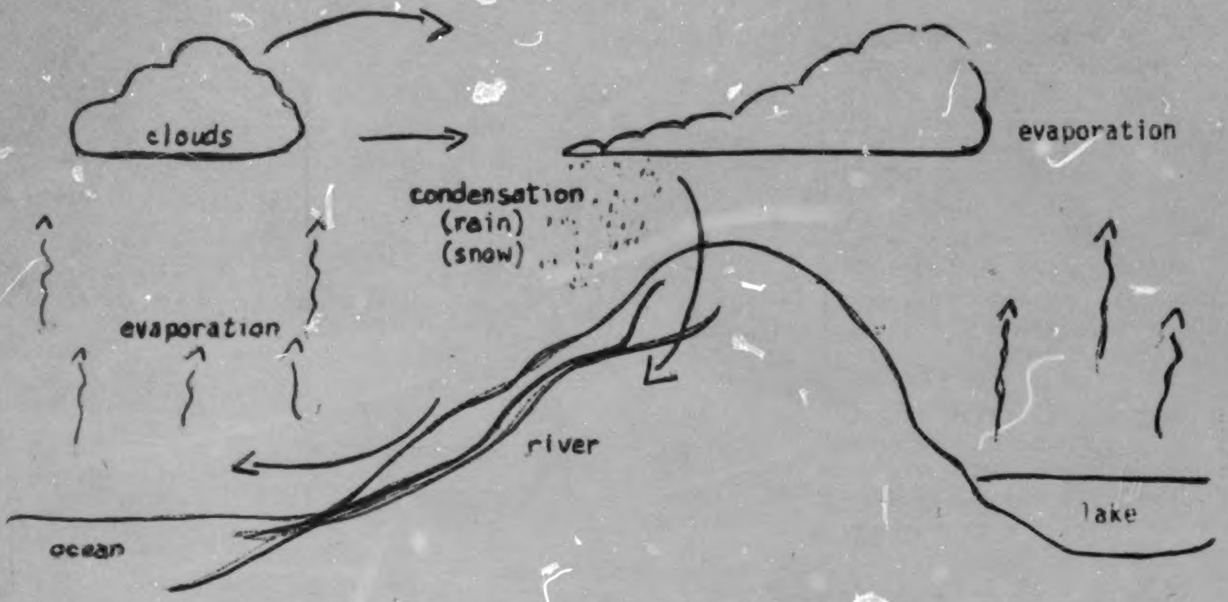
clouds
condensation
(rain)
(snow)
evaporation
evaporation
river
lake
ocean

Diagram 1 - Water Cycles

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem II-C: Is our drinking water fit for consumption?	Local drinking water Beaker Wire gauze Bunsen burner Microscope	Demonstration II-D: (a) Evaporate some drinkable water in a beaker and show the residue to the students. (b) Observe sample of local river water under microscope. Have the students discuss the above demonstration. Discuss the problem of water pollution on our continent.	The students are required to record the observations in their note books and discuss in the class.
Problem II-C: What is water pollution?		The teacher should emphasize that the major portion of the earth's water is not fit for drinking due to man made pollution. He should also point out that one hundredth of one percent of the world's water sustains earth's total population. Experiment II-2 An Elementary Study of Water Pollution Provide three samples of water (tap water #1,	

<table>
<tr><th>Content</th><th>Examples, Apparatus and Material</th><th>Activities</th><th>Evaluation</th></tr>
<tr>
<td>Problem II-C (cont'd.)</td>
<td></td>
<td>distilled water #2, and mineral water #3) and ask the students to identify each according to the following data table.

Data Table

<table>
<tr><th></th><th>Water #1</th><th>Water #2</th><th>Water #3</th></tr>
<tr><td>Taste</td><td></td><td></td><td></td></tr>
<tr><td>Colour</td><td></td><td></td><td></td></tr>
<tr><td>Any other Difference</td><td></td><td></td><td></td></tr>
</table>

Ask the students to compare the results with other members of the class.

The teacher should emphasize that man made pollution is a serious threat to our society,</td>
<td>The students are required to note the observations in their note books and answer the following question "What causes some water to be different from others?"</td>
</tr>
</table>

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem II-C (cont'd.)		and it is a product of our modern society. Emphasize that there was a very limited problem of water pollution before the white man came to this continent.	
What are main types of water pollution?		The teacher should explain three main types of water pollution: poisoning with pesticides, bulk sewage and the water entroplication.	
	Poisoning with pesticides is another fairly serious problem. Many pesticides such as sodium flouride, hydrogen cyanide and many arsenic compounds like lead arsenate, calcium arsenate are used in great quantities to kill bugs. Fish caught far out in the sea have been examined and found to contain these poisons. Bulk sewage is a serious pollution problem. Untreated water from sewage pipes carry bulk debris into the dumping waters. Most of the debris is toilet paper and dumping water. The worst type of water		

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem II-C (cont'd.)	pollution is eutroplication, meaning, "well nourished." To quote Dr. Francis T. Mayo, Great Lakes Regional Director of the Federal Water Quality Administration, "A Lake becomes over nourished as part of its normal aging process, but man accelerates the process tremendously by pouring in nutrients and industrial chemicals." [1] The main source of nutrients are sewage, industrial wastes, farm fertilizers, and worst of all soap.	Field Trip II-A Arrange a field trip to visit a reserve and observe the impurities in the natural water. Discuss the danger of contracting typhoid from impure drinking water. Also discuss dangerous parasites such as amoeba. The teacher may quote H.J. MacDonald from his article Through A Glass Darkly - Our Drinking Water Can't Be Trusted	

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[1] Young, op. cit.

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem II-C (cont'd.)		"In Skaha, B.C., in 1968, residents suffered mysterious intestinal troubles, allergies and infectious rashes, attributed to massive algae growth from pollution in the area's drinking water source."[2]	
		Ask the students to discuss at home the harmful effects of impure drinking water and report the results of the discussion to the class.	The students will be evaluated from their verbal report of their parents' reactions.
		Round Table Conference	
		Have the students sit in a circle with the teacher. The students are asked to discuss their parents' reaction in the discussion of harmful effects of drinking impure water.	
Problem II-D:		The teacher should explain the distillation process.	
How can we purify our drinkable water?	Distillation Flask Bunsen burner Wire gauze	Experiment II-3	
(a) Distillation		Methods of making water potable. Distillation:	
		The students are required to	

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[2] MacDonald, Op. cit, p. 2

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem II-D (cont'd.)	Distillation equipment Filter paper Funnel Beaker	set up the distillation equipment as shown in the labelled diagram drawn by the teacher on the black board. Have the students distil drinkable water and keep the residue as well as distillate. Have the students discuss the applicability of distillation in the community for purification of drinking water. The teacher should help in concluding the discussion emphasizing that distillation is a good laboratory method, but it is used on a small scale in the community.	The students are required to note the observations in their note books to describe the principles involved in distillation.
(b) Sedimentation	Chalk Mud Beaker containing water	Demonstration II-C Put a lump of mud or chalk from the reserve in water and disperse it. Allow the beaker to stand for 15 minutes. Discuss the use of settling basins in purification of water.	The students are asked to write a description of the process of sedimentation in their own words.
(c) Filtration	Chalk Gravel Coarse and fine sand	Demonstration II-D Demonstrate the filtration of a chalk suspension through	The students are asked to write their

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem II-D (cont'd.)		a filter bed consisting of gravel, coarse and fine sand.	observations of the process of filtration in their note books and will be evaluated on the basis of their explanation of the filtration process.
(d) Aeration	Beaker Bunsen burner Local drinking water	Demonstration II-E Have the students taste the local drinking water before boiling and after boiling. The students are led into discussion and a conclusion can be drawn that aeration can be achieved by spraying water into air or allowing water to flow over rocky masses.	
(e) Use of bleach	Drinking water Beaker Bleach	Experiment II-4 Have the students purify water by the use of bleach. Add a few drops of bleach to the impure water. Tell the students that chlorine is used in killing disease-producing bacteria. Field Trip II-B	The students are asked to purify the sample of impure water brought from their homes and check it.

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem II-D (cont'd.)		Arrange a trip to visit the nearest town to demonstrate the process of chlorination and filtration used in the municipal purification unit.	The students are required to write a report on the methods used in the purification of drinking water in their community.
Problem II-D: What should be the characteristics of our drinking water?	Samples of local drinking water Distilled water	Have the students compare the samples of local drinking water with distilled water. Discuss the findings and help students summarize the differences. (a) Pure water is free from all harmful bacteria and the desirability is that it should be colourless, odourless and pleasant in taste.	The students are required to write down the characteristics of drinking water.
Problem II-E & F: What is the chemical composition of water by volume?	Beaker Water Lead or carbon electrodes Sulphuric acid	Demonstration II Electrolyze water containing a small amount of H_2SO_4 using lead or carbon electrodes. Emphasize the volume relationship of the hydrogen and oxygen produced. Do reverse also and combine two volumes	The students are required to write their observations in their note books and discuss the observations in class.

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem II-F (cont'd.)		of hydrogen and one volume of oxygen. Have the students discuss the above demonstrations and develop an operational definition of chemical formula. The teacher should review the concepts of chemical and physical change with reference to the above demonstration of the composition of water. He should compare the above changes by studying the examples of electrolysis and boiling of water.	The students are required to write operational definitions of chemical formulas, chemical and physical changes.
Problem II-G:		**Experiment II-5**	
What is air pollution?	Photographs or pictures concerning air pollution from various sources, such as the automobile, industry etc.	Have the students examine photographs concerning air pollution from various man made sources. Also, have the students examine natural sources of air pollutants and identify the pollutants in air in your community.	
		Procedure **Part I**	
		(1) Obtain various old picture magazines which will be	The students are required to note the

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem II-G (cont'd.)		supplied to you by your teacher. (2) Find a number of pictures illustrating the causes of air pollution. (3) Classify the pictures according to natural pollution and man-made pollution. (4) Further classify your material under various other headings, e.g., (a) natural pollution by pollen-producing plants, (b) by volcanic action. __Part II__ (1) Obtain several utility pails and fill them half full of water. (2) Place the pails in unprotected outdoor areas such as, near window. (3) After 24 hours check for evidences of foreign matter. Leave the pails untouched.	observations in their note books and are asked to answer the following question: "Suggest ways to reduce air pollution."

<table>
<tr><th>Content</th><th>Examples, Apparatus and Material</th><th>Activities</th><th>Evaluation</th></tr>
<tr><td>Problem II-G (cont'd.)</td><td></td><td>(4) After one week, check again for evidence of foreign matter.

(5) Collect the material in your pail with cheese cloth. Identify as much material as you can.

(6) Compare with other students.

Part III

(1) List samples of pollutants found in your reserves or residence.

(2) Divide these samples into natural, and man-made pollutants and place in a data table.

Data Table
<table>
<tr><th>Pollutants</th><th>Natural</th><th>Man Made</th><th>Harmful To People</th></tr>
<tr><td>cars</td><td>-</td><td>x</td><td>x</td></tr>
<tr><td>smoke</td><td>-</td><td>x</td><td>x</td></tr>
<tr><td>sandstorms</td><td>x</td><td>-</td><td>x</td></tr>
</table></td><td></td></tr>
</table>

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem II-H: What is food pollution?	Some canned food such as beans, peas etc.	The teacher may discuss the following information (may be in the form of a round table conference). Most foods that we buy have chemicals added to them. Chemicals help to preserve food. Even fresh fruit and vegetables are sprayed with chemicals to keep them fresh. Many of these chemicals are harmful to people, some appear not to be. Chemicals are used to flavour food. Many flavourings have been tested on animals. Some affected the heart, others decayed the liver. Many caused allergy. Methylcellulose (a chemical) is used to thicken jams and jellies and in some diet pills. It was found to increase heart attacks in rabbits. Another chemical, propylene glycol, caused deformed limbs in young chicks. Other chemicals caused intestinal troubles. Most of our food has chemical additives and many of them can be harmful.	

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem II-H (cont'd.)		Suggested Activities for Students: (a) Collect newspaper and magazine articles on chemicals in food. (b) Ask the librarian to help you find out about chemicals in food. (c) Make a list of harmful chemicals found in food. Write beside each the effect it may have.	
NOTE: The teacher may emphasize that there was a limited problem of food pollution before the non-Indian came to this continent.		(d) Read the labels on food packages and cans. Make a list of foods which contain harmful chemicals. This can be done at home or at the supermarket.	The students may be evaluated from the following questions: (1) What foods contain the most harmful chemicals? (2) What can be the result of eating these foods? (3) What can we do to prevent harm from food pollution?

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem II-I: What is oil pollution?		The teacher should point out that the problem of oil pollution was non-existant before the arrival of Europeans. Now oil is found floating on the water and washed up on the beaches. Most oil is transported by ships. At present,more than 700 million tons of oil are carried by ships in a year. The amount of oil carried by ships is increasing. It will probably double by 1980. Most of this oil is crude oil which is very poisonous. Oil tankers wash their tanks regularly. In a year, about 300 thousand tons of crude oil are dumped in this way. Suggested Activities for Students (a) A field trip to an ocean beach. Look for globs of thick black oil washed upon the beach.	

Buzz Morisette, a counsellor for the Native court workers, termed alcoholism a "national disaster"for Indians.

"I know it has affected every Indian I've come across," he said. "In one way or another, alcoholism affects 100 percent of Indian people. Until very recently, no concentrated effort has been made to deal with alcoholism in B.C. and very little in the rest of Canada."

Psychiatrist Louise Jilek Aall, who has treated Coast Indians for seven years said 90 percent of her patients had alcoholism problems.

---- SEMINAR DISCUSSES INDIAN'S TROUBLES, The Vancouver Sun, July 19, 1974, page. 2

** The author believes that supplying relevant information concerning alcohol and psychic drugs in our schools might help in overcoming the above problem.

- R.M.K.

UNIT III

PSYCHIC DRUGS, ALCOHOL AND YOU

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem II-I (cont'd.)		(b) Collect newspaper and magazine articles on oil pollution and discuss them in class.	The students may be evaluated from their responses to the following questions: (1) How does oil pollution affect: (a) people (b) birds (c) fish and other marine life (2) How can we cut down damage by oil pollution? (3) Can we totally prevent oil spills? (4) If oil pollution is not stopped, what will happen? (5) Does free enterprise have a right to pollute?

UNIT III

Psychic Drugs, Alcohol and You (Suggested Time: 20 - 25 hours)

CONTENT

A. Major categories of drugs

B. Medicinal uses and abuses of:
   (i) Tranquilizers
   (ii) Narcotics
   (iii) Hallucinogens
   (iv) Stimulants
   (v) Sedatives
   (vi) Miscellaneous

C. Suggested activities regarding drug education

D. Abuses of alcohol

OBJECTIVES

(1) To provide an understanding of the effects of drug abuse, so that the students may be aware of harmful effects of these drugs.

(2) To familiarize the students with the various psychic drugs which are used by drug users and pushers.

REFERENCES

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- *Drug Abuse and You*. (Victoria (B.C.): (Department of Health Services and Hospital Insurance, 1970))

- Gordon Wolstenholme, *Drug Responses in Man*. (London: J and A Churchell, 1967)

- Ruth, D. Musser, *Modern Pharmacology and Therapeutics*. (New York: Macmillan Company, 1959)

- Samuel, Prager, *The Medicated Society*, (London: Macmillan Company 1965)

- What You Should Know About the Use and Abuse of Alcohol (Victoria: Government of British Columbia, Council on Drugs, Alcohol and Tobacco)

- The Alcoholism Foundation of British Columbia:

  Head office and Greater Vancouver Regional Office,
  175 West Broadway, Vancouver 10.

  Vancouver Island Regional Office and Clinic
  180 Meares Street, Victoria.

  Kamloops - Okanagan Regional Office,
  523 Victoria Street, Kamloops.

  Cariboo - North Coast Regional Office,
  1448 Sixth Avenue, Prince George.

Content	Examples, Apparatus and Material	Activities	Evaluation
Problem IIA:			
What are major categories of drugs?		Tell the students that there are six major categories of drugs. (1) Tranquilizers (2) Narcotics (3) Hallucinogens (4) Stimulants (5) Sedatives (6) Miscellaneous	
		Define the above categories of drugs. For example, tranquilizers are drugs which are used to induce calmness, reduce tension and anxiety.	
		These drugs are available in the form of colored pills and capsules.	
		Chronic abuse of these drugs may result in the development of physical or psychological dependence.	
Problem IIB:			
What are medicinal uses and abuses of the following drugs? (1) Tranquilizers		Excessive use may cause side effects: Headache, skin rashes, stomach disturbances,	

Content	Examples, Apparatus and Material	Activities	Evaluation
		urinary frequency; withdrawal symptoms - include insomnia, vomiting, shaking, loss of appetite, lack of muscular coordination, fever and on occasion, death. This drug when taken with alcohol can produce harmful effects. The most frequent tranquilizers diverted into illicit trade are meprobamate (equinil, Miltown) and glutethimide (Doriden)	Have the students write a short report on hazardous effects of the abuse of tranquilizers.
What do you mean by physical and psychological dependence?		Have the students discuss the terms of physical and psychological dependence. Summarize the state of physical dependence as a state of adaptations to a drug such that signs and symptoms of bodily discomfort appear when the drug is withdrawn abruptly. Also, summarize psychological dependence as a strong emotional or mental drive to take a drug, either to obtain pleasure or to avoid discomfort.	

Content	Examples, Apparatus and Material	Activities	Evaluation
(2) Narcotics - drugs like: (a) Morphine (M, Mary, White Mojo)		Tell the students that natural and synthetic morphine-like drugs are the most effective pain relievers. Morphine is available as a fluffy, white powder found in cubes or tablets and is extremely bitter. These may be eaten or injected under the skin or intravenously. These drugs produce a sense of euphoria (an exaggerated sense of well being), drowsiness, nausea, urinary retention. In severe cases, the user may go into a coma. Death results when the individual can no longer breathe. Morhpine users are generally lethargic and indifferent to their environments and personal situation. Hazardous effects of this morphine are physical and psychological dependence, painful withdrawal symptoms,	Have the students write a short note on hazardous effects of Narcotics.

Content	Examples, Apparatus and Material	Activities	Evaluation
		destruction of brain and liver, danger of acquiring hepatitis from contaminated needle and death from over dose.	
(b) Heroin (H, stuff, junk, horse, smack, Harry, dynamite)		Heroin is available as a white crystalline powder, slightly bitter. May be sniffed, rarely taken by mouth or injected under the skin or intravenously. Signs and symptoms and hazardous effects are same as morphine.	
(c) Codeine		Tell the students that codeine is approximately one-tenth as toxic as morphine. Codeine is usually available in the form of tablets or in cough syrups.	
		Signs and symptoms and hazardous effects are same as morphine but milders.	Have the students write an operational definition of "psychedelics"
(d) Hallucinogens		Tell the students that hallucinogens are drugs which cause hallucinations. These drugs produce distortion of perception, and dream images.	

Content	Examples, Apparatus and Material	Activities	Evaluation
		These are called psychedelics.	
A. Toxic solvents such as: glue, nail polish remover, gasoline		Tell the students that frequent use of the toxic solvents produces psychological dependence, dizziness, headache, nausea, slurred speech and blurred vision and feelings of euphoria.	
		Harm may be done to the brain, liver and kidney; and death due to suffocation is possible. Users generally have sweetish, sickly odour on breath and clothing.	Have the students write a short note on "Tonic Solvents" and "Marijuana" in their own words.
B. Marijuana, (cannabis) (pot, Mary Jane, Tea, weed grass, Mary Warner, rope, hemp jive)		Tell the students that massive doses of marijuana may cause altered awareness of time and space, visual distortions and hallucinations. Mood changes ranging from anxiety at first to euphoria may occur.	
		Marijuana is brownish green, dried and shredded leaves with a pungent smell. It is smoked in a type of pipe or inhaler or as cigarettes.	

Content	Examples, Apparatus and Material	Activities	Evaluation
C. Hashish (hash)		Tell the students that Hashish is available as a dark amber resinous material extracted from the flowering tops of the cannabis plant. It is smoked in a pipe or in a cigarette. Symptoms and hazardous effects are same as Marijuana.	
D. LSD (d-Lysergic acid diethylamide) common names: acid, the chief, the hawk, the cube, big oz, orange wedge, sugar, 4-way, Big "A"		Tell the students that LSD was synthesized in 1938 from lysergic acid present in fungus that grows [illegible] rye and is available in the form of white powder or tablets or liquids or soaked into sugar cubes, clothing or blotting paper.	
		LSD primarily affects the central nervous system producing changes in mood and behaviour.	
		Hazardous effects involve physical and psychological dependence, extremely horrifying hallucinations (bad trip or bum trip).	
		Use of LSD may lead to chromosome damage and birth	

Content	Examples, Apparatus and Materials	Activities	Evaluation
		defects and suicidal urge.	
E. Mescaline (Dimethyl Tryptamine) common names: mescal, buttons, cactus, peyote		Tell the students that mescaline is obtained from the Mexican cactus Anhalonium. It is available in the form of gelatin capsules or in a form to be mixed with water or injected intravenously. Hazardous effects and symptoms are same as those of LSD.	
F. STP (Serenity, tranquility, peace, DOM)		Tell the students that STP is available in the form of blue or orange capsules or tablets which are swallowed. The peak effects occur three to five hours after being taken. Dryness of mouth, nausea, restlessness, dilated pupils are common signs and symptoms. Visual hallucinations, visual distortions, and mood changes may occur similar to LSD.	
G. Stimulants		Tell the students that stimulants stimulate the central nervous system. For example, coffee, tea, cola. The synthetic stimulants are	

Content	Examples, Apparatus and Materials	Activities	Evaluation
		amphetamine and cocaine.	
(a) Amphetamines common names: speed, bennies, pep pills, ups, dexies, co-pilots, footballs, crystal		Amphetamines are white, odourless, water soluble, bitter powder or volatile colourless liquid with strong odour. Amphetamines may be sniffed, taken orally, or injected. Large doses produce fever, heart irregularities, convulsions or coma. Death may result from circulatory collapse. It may also produce euphoria, insomnia, loss of weight, compulsion to talk and paranoid behaviour.	
(5) Sedative Barbiturates "goof balls"		Tell the students that sedatives have a depressant effect on the nervous system. The most commonly abused drug is "Barbiturates" or the street term is "goof ball." It is available in the form of	

Content	Examples, Apparatus and Materials	Activities	Evaluation
		pills, capsules, and injectable preparations. Hazardous effects are: Incoherency, intoxication, staggering gait, slurred speech, vomiting, drowsiness and depression. In large doses may produce tremors, anxiety, delirium, convulsions, coma and death.	
(6) Miscellaneous Stramonium		Tell the students that Stramonium is available as a brownish green powder. It is taken by inhaling the smoke of the powder when burned, or by swallowing. Dryness of mucous membrane, burning in throat, difficulty in swallowing, skin rash, rapid heart rate, and convulsions are the common signs and symptoms. Activity No. I Have students send away for literature on drug use and	

Content	Examples, Apparatus and Materials	Activities	Evaluation
		abuse. The World Health organization, local health unit and Provincial department of health services are reliable sources.	
		Guest speaker	
		Invite persons with professional experiences with drug abuse problems and request them to speak on the drug uses and abuses.	
		Invite someone, who has been an addict or has abused drugs.	
		Field Trip	
		Have students compile a list of community agencies concerned with drug abuse, and arrange a field trip to some of those agencies.	The students will be evaluated on the basis of the number of clippings regarding drug abuse.
		Have students collect newspaper clippings and magazine articles on drug abuse.	The students will be evaluated on the basis of their written reports on the effects of hallucinogens on our
		Have students write research papers on such topics as	

Content	Examples, Apparatus and Materials	Activities	Evaluation
		"Effects of Hallucinogens on our General Health."	general health.
Problem: What are abuses of alcohol?		The teacher should point out that the problems arising from alcohol are more dangerous than the drug problem. The students should be told clearly and emphatically that when we drink alcohol, it means we put a drug into our system which may produce damage to the digestive tract and kidneys. It may also produce impaired memory, chronic unco-ordination and malnutrition.	
What are different stages of drinkers?		There are three stages of drinkers: (i) casual (ii) habitual (iii) addicted The teacher may define the above terms in the following manner. Casual drinker is a person	

Content	Examples, Apparatus and Materials	Activities	Evaluation
		who drinks irregularly, and not because of overwhelming craving.	
		Habitual drinker is a person who drinks regularly because of increasing dependence on alcohol - i.e., wine, beer or hard liquor every day. We may say that a habitual drinker is dependent on alcohol. One may spend more money on alcohol than one should. Some of the psychological damage is done at this stage.	The students are asked to write a short note (in their note books) about the three different stages of drinkers, i.e., casual, habitual and addicted. The students will be evaluated from the above response.
		Addicted drinker when a person becomes compulsive drinker. Drinking means everything to him.	
Problem: What are the danger signals of becoming addicted to alcohol?		The teacher may discuss the following signals of an alcoholic. - drinking excessively - craving a drink in the morning or when depressed - gulping drinks - feelings of guilt - blackouts	The students are asked to summarize the danger signals of an alcoholic in their note books.

Content	Examples, Apparatus and Materials	Activities	Evaluation
		- hangovers - hallucinations - physical tremors - bad temper	
Problem: What happens in our system when we drink alcohol?		Have the teacher explain to the students, the mechanism of alcohol absorption in the human system. For example, alcohol gets absorbed into our blood stream through the walls of the stomach and the smaller intestine. When absorbed it is distributed throughout the body fluids. The rate of absorption depends on the amount of alcohol found present in the system. About 95% of the alcohol is utilized by the liver. The rest is eliminated in the urine. The liver can handle only a limited amount at a time (approximately one drink per hour). When the liver cannot burn excessive alcohol, the remaining alcohol stays in the system and interferes with the functions of the central nervous system, resulting in	The students are required to write a short note about the mechanism of alcohol absorption in the body.

Content	Examples, Apparatus and Materials	Activities	Evaluation
		embarassing behaviour, temporary loss of memory, and nausea.	
Problem: III-C What are the long term effects of alcohol?		The teacher may point out that excessive drinking may lead to the following disorders in the human system: (i) digestive tract disorders (ii) cardiovascular disorders (iii) kidney disorders (iv) impaired memory (v) chronic unco-ordination (vi) sexual impotence (vii) Malnutrition (viii) physical dependence which may result in withdrawal symptoms such as nausea, anxiety, confusion, sweating, cramps and vomiting. (ix) psychological dependence which may result in depression and boredom.	The students are asked to write a short note on the long term effects of alcohol. The students are evaluated on the basis of their written responses.
	Medical Doctor or local health unit official	The teacher may invite a local doctor or local health unit official to discuss the long term effects of alcohol in detail. If possible, a	

Content	Examples, Apparatus and Materials	Activities	Evaluation
		film about alcoholism may be shown.	
Problem: III-C How does drinking alcohol affect driving?		The teacher should mention the following facts: Alcohol affects reflexes immediately. Alcohol narrows the perhipheral vision. The average person is impaired with a .05% blood alcohol level. It is an offence to drive a car with a blood alcohol level of over .08%. A person weighing 150 lbs. and having 5 ounces of hard liquor or 3.5 bottles of beer could exceed a blood alcohol of .10%. Have the teacher emphasize that the only safe policy is not to drink at all if you are driving. Have the students discuss the abuses of alcohol with their parents and friends.	The students are asked to write their views about the effect of drinking while driving an automobile.

UNIT IV

Native Indian Scientific Knowledge

A. Native dyes and natural dyeing

B. Modern dyeing techniques

C. Production of yarn and thread

D. The Indian way of life - a scientific study of a scientific environment

for the above information, please refer to Chapter III.

UNIT V

PLANTS AND NATIVE PEOPLES IN BRITISH COLUMBIA

Nancy J. Turner

AUTHOR'S NOTE

The information in this unit is greatly abbreviated and simplified, but it is hoped that it will give secondary school students of all cultural backgrounds a better appreciation of the richness of native cultures in British Columbia by dealing in a practical way with an aspect of one of those cultures; namely, the relationship of native peoples with their surrounding vegetation.

It is recognized that this unit is part of a "pilot project"aimed at producing a more meaningful education program for native students in B.C. As such, it is offered only as a sample of the type of information which could be included in a final presentation.

Due to lack of financial resources, there are no illustrations accompanying this unit, but photographs or drawings could easily be accommodated at a later stage if this is considered desirable.

For further information, teachers are urged to consult the references listed at the end. More information on this subject is appearing all the time, but there is yet much to be recorded.

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UNIT V

Plants and Native Peoples in British Columbia

Introduction: The Importance of Plants

For many thousands of years plants have been a major source of food, raw materials, and medicines for the Native peoples of British Columbia. The economic importance of plants has resulted in their being highly significant in native language, religion, and folk-lore.

This unit will investigate some of the ways in which plants were utilized in different parts of British Columbia.

Today, in most areas of the Province, only the oldest Native people remember details of the use of wild plants in the days before the white man came with his grocery stores and patent medicines. Some wild plants are still used as food or medicine, but most are forgotten or used only rarely. It is hoped that this unit will rekindle interest among younger members of Native communities in the historical and practical value of plants in British Columbia.

There are approximately thirty different native language groups in the Province, spread over eleven major vegetation zones. As might be expected, the names of plants and the types of plants utilized vary considerably from group to group. Well over four hundred different species of plants were named or utilized in some way in one or more language areas. Of necessity, only a small number of these can be covered here, but those of highest significance or greatest cultural interest will be stressed.

A. Wild Plant Foods

Plant foods of many kinds were utilized by Native British Columbians. Roots, rhizomes, bulbs, and tubers provided carbohydrates, just as potatoes and rice do in our modern diet. Especially in springtime, green vegetables, seaweed, and tree cambium were harvested and eaten as one might eat spinach or celery today. Some seeds and nuts were also used, and an almost infinite variety of berries and fruits were gathered during the summer and fall, to be eaten fresh or dried for use throughout the winter months. Many of these berries are still used by Native peoples today, but are usually made into preserves or frozen instead of being dried. Wild plants provided even teas and tobacco, as well as flavourings and appetizers.

You may wish to try some of the truly Canadian foods listed here, but you should never try anything if you are not absolutely sure of its identification. There are only a few deadly poisonous plants in British Columbia, but some of them look similar to well known edible plants, and one mistake in identification could be enough to make you seriously ill, or even kill you.

Additionally, many edible plants are rare and beautiful species, whose numbers could be seriously depleted by excessive harvesting. Picking berries and selectively harvesting greens will not harm plant populations, but digging edible roots and bulbs and scraping off tree cambium can be highly detrimental, and should be avoided except in emergencies.

Roots, Rhizomes, Bulbs, and Tubers

Most of these were dug in spring or fall, using long sharp digging sticks. Some were eaten raw, but many were steam-cooked in large pits lined with red-hot rocks and covered with leaves, branches, and soil. Some were strung and dried for winter use.

(1) Bracken Fern (*Pteridium aquilinum*)-The long black rhizomes were dug in fall throughout the British Columbia coast, roasted in ashes, and pounded to remove the outer covering. Then the white starchy inner part was eaten with oil or fish eggs.

(2) Wild Clover (*Trifolium wormskjoldii*) and Pacific Cinquefoil or Silverwood (*Potentilla pacifica*) - These plants grow in abundance in saline marshes and estuarine flats along the Pacific Coast. Another closely related silverweed (*Potentilla anserina*) is found in alkaline marshes in the Interior. The long thin roots were dug, steamed, and eaten in many areas of the Province. The Kwakiutl actually divided their clover and cinquefoil patches into well kept gardens which were owned by certain members of the tribe and passed down from generation to generation. They ate these roots with oulachen grease at large communal feasts.

(3) "Indian rice" (*Fritillaria lanceolata* and *F. camschatcensis*)-These plants are in the lily family. The first is often called Chocolate Lily and the second, Mission Bells. They have white flattened bulbs with numerous small bulblets around them which resemble rice. These bulbs were dug, steamed, and eaten, especially by the coastal Indians. They have a slightly bitter taste.

(4) Blue Camas (*Camassia quamash* and *C. leichtlinii*)-Blue Camas has been probably the most important source of carbohydrates to the Coast Salish people of Vancouver Island. Like "Indian rice", it is a member of the Lily Family. The bulbs grow in abundance around the Victoria area and on the Gulf Islands. In the past, Salish families would harvest hundreds of pounds of them every year, and cook them in large steaming pits overnight until they were soft and dark. They were also eaten by the southern Okanagan people, and are very common in eastern Washington and Idaho.

WARNING: This edible camas has a blue flower, but there is another type of camas, known as white or death camas (*Zygadenus venenosus*) which has creamy white flowers and whose bulb, similar to that of the blue camas, is deadly poisonous to livestock and humans alike. Great care must be taken that these two plants are not confused, since they often grow together. Where there is any doubt, the blue camas should be dug when it is in flower.

(5) Yellow Avalanche Lily, or Yellow Dogtooth Violet (*Erythronium grandiflorum*)-This beautiful lily grows in mountain valleys in the southern part of the Province. The slender white "roots" (technically corms) were dug, steamed, and eaten by all the Interior Salish peoples. They were

commonly strung and dried for winter after cooking. Some Native people call them "Indian sweet potatoes", although they are slightly bitter.

(6) Tiger Lily (*Lilium columbianum*)-This tall orange-flowered lily is found throughout southern B.C. Its large segmented bulb was dug and eaten wherever it was available. It was usually boiled in soups or stews, as it was too bitter to eat alone.

(7) Nodding Onion (*Allium cernuum*) and other wild onions (*Allium* spp.)-Several species of wild onions occur in B.C., the most common and widespread being the pink-flowered nodding onion. The bulbs are elongated, pink-skinned, clumped, and characteristically onion-odoured. They were dug and eaten by almost all British Columbia Indian groups, especially the Interior Salish, who tied them together in bundles and steamed large quantities of them in pits. Some call them "barbecuing onions". The best time to gather them is just before they flower in late spring.

WARNING: Wild onions could be mistaken for death camas, which is often called "poison onion" by native people. However, only the true onions have an onion smell to them.

(8) Desert Lily, Mariposa Lily, or "Sweet Onion" (*Calochortus macrocarpus*)-This beautiful flower is restricted to the dry interior of British Columbia. It has small spherical bulbs which are sweet and crunchy. These were eaten raw by the Interior Salish.

WARNING: Care must be taken not to confuse these bulbs with death camas bulbs. Check the large pinkish flower.

(9) Spring Beauty or "Indian Potato" (*Claytonia lanceolata*)-This is a flower of mountain valleys, often growing with the yellow avalanche lily in the interior of the Province. The small spherical tubers, about the size of one's thumbnail, were dug in late spring by all Interior Salish groups. They were steamed in pits or boiled until soft and eaten in large quantities. They were a favourite vegetable, and some people still enjoy eating them today.

Botanie Valley, near Lytton, in Thompson Indian territory, has traditionally been a common area for digging these roots, as well as those of the yellow avalanche lily. Neighbouring groups from Lillooet and Shuswap territories would come to Botanie each year to trade for them.

(10) Balsamroot or Spring Sunflower (*Balsamorhiza sagittata*)-In springtime these flowers clothe the hillsides of the Okanagan and Kootenay areas in gold. They are a smaller version of the garden sunflower. In May and June, the Interior Salish people dug out the massive taproots, pounded them until the outer skin came off, and steamed them for up to two days. At this stage, they were sweet and tender, and were eaten almost as a dessert. They could also be dried for future use. Later on they become tough and pitchy and are no longer good to eat. The subterranean buds, bud stems, and seeds of this plant are also edible.

(11) Hog Fennel or "Indian carrot" (*Lomatium macrocarpum*)-This plant is in the carrot family. It has white flower heads, finely dissected leaves, and a long fleshy taproot, which was dug and eaten in late spring by the Interior Salish peoples. It tastes somewhat like a carrot or parsnip, but

is more "biting" or bitter. Several other species in the genus *Lomatium* were used as food or medicine by British Columbia Indians.

(12) Bitterroot or Sand Rose (*lewisia rediviva*)-This beautiful flower of the dry areas of the Interior has a large branching taproot, which was one of the most important edible roots of the Okanagan and Kootenay Indians. It was widely traded to other Interior Salish groups. The roots were dug before the plant flowers, in late May. They were peeled and dried, then boiled in soups or stews, or mixed with berries and eaten as a dessert.

Green Vegetables

Most greens were gathered in the spring time, as tender young sprouts. In the early days, most were eaten raw, usually with oil, fish, or meat. They provided a welcome change from the monotonous diet of winter.

(1) Cow Parsnip or "Indian rhubarb" (*Heracleum lanatum*)-This tall member of the carrot family is found throughout British Columbia. The Parsnip River of northern B.C. is named from the abundance of cow parsnips in that region. The young leaf and flower stalks were an important food of all Indian peoples in the Province. They must be peeled before being eaten, and after the plants flower, they are no longer edible. On the coast they were eaten with oulachen grease and sugar (sugar was available only after white contact).

WARNING: Several members of the carrot family are extremely poisonous. One in particular, the water hemlock (*Cicuta douglasii*), could be mistaken for the cow parsnip, since it has similar flower heads, although smaller, and the leaves are much more finely dissected than those of the cow parsnip. The genus *Cicuta* is considered the most poisonous in North America; a minute piece of root would be enough to kill a cow. The water hemlock grows in swamps and around the edges of lakes, while the cow parsnip grows in damp meadows and along roadsides. Check the leaves very carefully, and be sure you know the difference between these two plants.

(2) Fireweed (*Epilobium angustifolium*)-Almost anyone in B.C. is familiar with this tall purple-flowered plant of clearings and burns. The young stems, before the plants flower, were peeled and eaten by most of the Province's Indian groups. The inside is sweet and crisp, although slightly glutinous. The outer stem fibres were used by some groups to make twine and fishing nets.

(3) Stinging Nettle (*Urtica dioica*)-The young stalks, up to about 6 inches high, were picked and boiled as greens, Cooking fortunately eliminates the stinging properties of the leaves and stem. The stem fibres of the stinging nettle were also used to make twine and fishing nets.

(4) Thimbleberry (*Rubus parviflorus*) and Salmonberry (*R. spectabilis*)-The Coastal Indians harvested the young sprouts of these two berry bushes in spring, before they had turned woody, then peeled, and ate them raw or boiled. They were often dipped in grease or oil and eaten with fish eggs.

(5) Eelgrass (*Zostera marina*)-This grass-like plant is one of the very few true flowering plants growing in the ocean. The Kwakiutl, Haida, and other coastal groups gathered large quantities of it at low tide or from

canoes, stripped off the green ribbon-like leaves, and ate the white leaf bases and rootstocks raw, dipping them in oil first. This plant and a related species, seagrass (Phyllospadix torreyi), were allowed to collect herring eggs during the herring spawning season, then eaten with the eggs attached, or discarded after the eggs were peeled off.

(6) Balsamroot or Spring Sunflower (Balsamorhiza sagittata)-The large taproots of this beautiful plant were eaten (see previous section). Before the leaves and flowers appeared above ground in the spring, the Interior Salish Indians would dig down where the last year's flower stalks were found, to get the tender whitish shoots. These were eaten raw and were well liked. Later, when the plants had sprouted, the bud stems were peeled and eaten raw.

(7) Indian Consumption Plant or "Indian Celery" (Lomatium nudicaule)-This plant is widespread in southern British Columbia, especially on Vancouver Island and at Botanie Valley. The Interior Salish gathered the young leaves and flower stems and ate them raw or boiled. They have a delicious aromatic flavour, like strong celery. The white leaf bases were also eaten. Botanie Valley was a favourite place to harvest this plant. Some people still eat the leaves today; they are now canned or frozen for winter use.

(8) Black Tree Lichen, or "Black Moss" (Alectoria jubata)-This is a dark, hair-like lichen which hangs from the branches of coniferous trees, especially in mountainous regions of the Interior. Virtually all of the Interior Indian groups used it as food to a greater or lesser extent. It was pulled off the trees in late summer, cleaned, washed, soaked in water, and steamed in pits, often with other foods such as wild onions. It cooked down into a gelatinous substance, which was then dried and stored for winter. It was eaten, especially as a starvation food, in late winter, when most of the other stored foods were used up. It could be mixed with meat or berries to make it taste better, although some people are very fond of it just plain.

(9) Edible Seaweed (Porphyra perforata and other Porphyra species)-This is a dark greenish-red membranous seaweed growing on rocks at the mid-tide zone. It was gathered in May when the plants were still small by the Nootka, Kwakiutl, Tsimshian, and Haida, as well as by some Coast Salish groups. It was dried in sheets or cakes in the sun, and then eaten by itself as a snack, or cooked with fish or other seafood. It is still widely used today. In the past it was an important trade food.

Tree Cambium

Cambium is the growing layer of cells between the bark and the wood of any tree or shrub. In the springtime, when the sap starts to run, it is especially thick and rich in nutrients. The cambium of some trees is bitter, but in others is sweet and pleasant tasting. British Columbia Indians utilized cambium from a variety of trees. The most common ones are listed here.

(1) Western Hemlock (Tsuga heterophylla)-Hemlock cambium was harvested by the Kwakiutl, Bella Coola, Tsimshian, and Haida Indians in late spring. It was scraped from the inside of the bark, pounded to make it tender, steamed, and dried in hard flat cakes. For use, it was soaked and mixed

with berries or oolachon grease.

(2) Sitka Spruce (*Picea sitchensis*)-The cambium was harvested by the Haida and Tsimshian, and prepared in the same manner as hemlock cambium.

(3) Black Cottonwood (*populus trichocarpa*)-The Northern Kwakiutl and Bella Coola were especially fond of cottonwood cambium, but it turned sour after two or three days, so had to be eaten fresh.

(4) Red Alder (*Alnus rubra*)-Some of the Coast Salish groups, such as Sechelt harvested alder cambium and ate it fresh in springtime.

(5) Lodgepole Pine (*Pinus contorta*)-Virtually all of the Indian groups of the Interior of British Columbia collected lodgepole pine cambium in June and ate it fresh or dried. It was gathered from trees of about one foot in diameter, and when it was at the right stage could be scraped from the wood in long strips.

(6) Ponderosa Pine (*Pinus ponderosa*)-Some Interior Salish people, such as the Okanagan, gathered and ate the cambium from this pine. It was eaten in much the same way as lodgepole pine cambium, but was collected about one month earlier.

Seeds and Nuts

British Columbia Indians did not eat any grains, such as corn or wild rice, in aboriginal times. Only a few seeds and nuts were available to them.

(1) Hazelnuts (*corylus cornuta*)-These are the wild counterpart of the filbert nut. They are found in many parts of the Province, especially southern Vancouver Island and the lower mainland. Wherever they grew they were harvested and eaten by Indian peoples. There were also sought after by squirrels and other animals, and an easy way of collecting them was to find a cache left by a squirrel. They were eaten raw and were considered a special treat.

(2) Pinenuts (*Pinus albicaulis*)-These come from a scrubby alpine tree known as whitebark pine, but are similar in size and taste to the pinyon pinenuts of the American Southwest. They were gathered and eaten by the Interior Salish and Kootenay Indians during their trips to the mountains. In late summer, the whole trees could be shaken, and the nuts would fall out of their cones onto the ground. Also, like hazelnuts, they could be collected from the caches of small rodents.

(3) Acorns (*Quercus garryana*)-The garry oak grows within a limited range on southeastern Vancouver Island and the Gulf Islands. The Coast Salish in this area used to harvest the acorns, boil them, and eat them, but they were apparently not a very popular food. In contrast, acorns from several other species of oaks were a staple article of food for some California Indian groups.

(4) Spring Sunflower seeds (*Balsamorhiza sagittata*)-The edible roots and shoots of the balsamroot have already been mentioned. The seeds resemble miniature sunflower seeds, but may be eaten without removing the shell. They were ground into a fine powder by the Interior Salish and used to flavour soups.

Berries and Other Fruits

Many types of wild fruits and berries are still used today in British Columbia, by Indians and non-Indians alike. It would be impossible to list all of the edible varieties here, but some of the most commonly used ones are mentioned.

(1) Huckleberries and Blueberries (Vaccinium spp.)-Over ten species of the genus Vaccinium were used as food by British Columbia Indians. Some, such as the red huckleberry (V. parvifoloium) are widespread and commonly used, while others, such as the moss cranberry (V. vitis-idaea), have a more limited range and are not as widely utilized. The red huckleberry ripens as early as July, while other species, such as the evergreen huckleberry (V. ovatum) do not ripen until well into fall. Many of these varieties were mashed and dried in cakes for winter.

(2) Salal (Gaultheria shallon)-Of all the berries on the British Columbia coast, this is probably the most common and widely used. It was an extremely popular type for drying into cakes, and was often mixed with other less palatable berries to improve their flavour. Large quantities were picked in August and September, cooked to remove some of the moisture, and poured into molds that were set on skunk cabbage leaves. They were then left to dry in the sun or over the fire. The northern groups, such as the Kwakiutl, Tsimshian, and Haida, mixed them with oolachen grease.

(3) Gooseberries and Currants (Ribes spp.)-Several varieties of gooseberries (with thorns) and currants (without thorns) were eaten by various Indian groups in B.C. Some, such as the stink currant (R. bracteosum) and the common gooseberry (R. divaricatum), were very popular, while others were eaten only in times of hunger. Some types were dried in cakes. Nowadays they are made into jams and jellies.

(4) Red Elderberries (Sambucus racemosa) and Blue Elderberries (S. cerulea)-Elderberries of one or both species were eaten by virtually every Indian group in B.C. The red ones were most commonly utilized along the coast and the blue ones in the Interior. Both types were usually cooked (steamed or boiled) before eating, and the seeds and stems were spat out as the berries were being eaten. Elderberries were often dried into cakes, but these were usually mixed with cakes of salalberries or other more palatable types for eating.

(5) Saskatoon berries (Amelanchier alnifolia)-These were eaten by all of the Province's Indian groups, but were most important to the Interior Salish, where they were a staple article of diet. They were of such significance that although botanists recognize only one botanical species of Saskatoon berry in British Columbia, most Interior Salish groups recognize and distinguish over five different varieties, on the basis of bush size, habitat, and characteristics of the fruit. Some varieties have berries with large seeds, some with small. Some are sweet tasting, and some are watery. Only certain varieties are considered good for drying in cakes, or nowadays, for canning and freezing. They are still extremely popular, and are eaten not only as a dessert, but also cooked in soups and with meat and fish.

(6) Bog Cranberries (Vaccinium oxycoccus)-This plant is a member of the same genus as the blueberries and huckleberries, but rather than

growing on bushes, the fruits grow on tiny vines hidden in the moss of bogs and muskegs. They ripen in October, and were harvested by Indian peoples wherever they could be obtained. They were eaten fresh or stored under water in boxes until they became soft. Then oil or grease was poured over them and they were eaten with spoons.

(7) Highbush Cranberries (*Viburnum edule*)-These are not at all related to the bog cranberries. They grow in clusters on tall bushes. They were eaten in most areas of the Province. They are best harvested after the first frost in the fall, when they become soft and sweet. The coastal Indians stored them in tall boxes under water or grease until they were needed during the winter. Then they were mixed with grease, and in recent times, with sugar, and eaten. The seeds and stems were removed by the eater. Many Indian people note that these berries have become scarce in some areas, especially on the Queen Charlotte Islands.

(8) Thimbleberries (*Rubus parviflorus*), Salmonberries (*R. spectabilis*), Blackberries (*R. ursinus*), Blackcaps (*R. leucodermis*), and Wild Raspberries (*R. idaeus*)-These berries are in the same genus, *Rubus*, as commercial raspberries, blackberries, loganberries, and boysenberries. They are sweet and juicy, and very popular amongst Indian people in the areas where they are found. Some groups dry them for winter, while others simply enjoy them when fresh. They have apparently become more abundant in the Province due to increased logging, burning, and clearing.

(9) Wild Strawberries (*Fragaria* spp.)-Three species of wild strawberries occur in British Columbia, and all were favourites of Indian people and were eaten wherever they could be found. They were seldom dried, however, because they were so juicy.

(10) Crabapples (*Pyrus fusca*)-These are small apples, the size of large peas, which hang in clusters from trees resembling commercial apple trees. They are found along the entire coast of the Province. The apples were harvested in fall and eaten fresh with oil or, like the highbush cranberries, stored in tall boxes under water until they became soft and lost their tartness. Today they are made into apple sauce or jelly.

(11) Chokecherries (*Prunus virginiana*)-There are two colour phases of chokecherries -- dark purple and clear red. Both varieties were eaten by the Interior groups, although the dark ones were considered of poorer quality. Chokecherries were formerly dried, and now are often frozen.

(12) Kinnikinnick berries (*Arctostaphylos uva-ursi*)-Kinnikinnick is well known for the widespread use of its leaves as tobacco, but few recognize the edibility of its grainy red-skinned berries. They remain on the plants throughout the winter, and can be gathered from under the snow when few other foods are available. They are dry and tasteless when eaten alone, but quite satisfactory if mixed with grease, oil, or butter. The Bella Coola used to make dumplings with them after flour was introduced.

(13) Bunchberries (*cornus canadensis*)-This plant is in the same genus as the floral emblem of British Columbia, the flowering dogwood, and is often called dwarf dogwood. It is a short herbacious plant of damp coastal regions and mountain forests. The red-orange berries, produced

in late summer, are sweet tasting, but each has a small hard seed in the centre which must be removed. Bunchberries were eaten fresh, usually with oil, or stored under water until needed.

(14) Soapberries (*Shepherdia canadensis*)-These berries are found in many areas of the Province, and where they cannot be obtained directly, they are acquired from neighbouring areas. They are extremely bitter. Rather than being eaten directly like other berries, they are mixed with water (about 1 cup water per 1/4 fresh berries) and whipped with a branch, or an egg-beater, until they form a stiff froth like beaten egg whites. Sugar is mixed in to taste, and the whip is eaten as a dessert. Today it is known as "Indian ice-cream", and is still a favourite food of Native peoples in many areas. The berries should not be allowed to come in contact with grease or oil, or they will not foam. Their Chinook jargon name is "soopalallie".

Teas, Tobaccos, and Flavourings

(1) Labrador Tea or Hudson's Bay Tea (*Ledum groenlandicum*)-This is a shrub of muskegs and peat bogs throughout British Columbia and most of northern Canada. The leaves are elongated, rounded at the ends, curled under around the edges, and characteristically wooly on the underside. They were harvested, dried, and brewed into an aromatic tea, either by steeping them in boiling water or by boiling them for awhile. A small handful of leaves per quart of water makes a very pleasant drink. This tea is still enjoyed by many Indian people today. Labrador tea flowers are white, while those of a close, poisonous relative, swamp laurel (*Kalmia polifolia*) are bright pink. The two plants grow together, but Labrador tea can be distinguished by the fuzzy undersides of the leaves.

Several other types of teas were made in different areas of the Province. The old leaves of thimbleberry (*Rubus parviflorus*) and trailing wild blackberry (*Rubus ursinus*) were used by the Coast Salish. The Bella Coola used the roots of wild ginseng or sarsaparilla (*Aralia nudicaulis*). The Thompson and Okanagan people made a drink, called "catnip" tea from the dried leaves and twigs of the dwarf wild rose (*Rosa gymnocarpa*).

(2) Kinnikinnick (*Arctostaphylos uva-ursi*)-This trailing shrub is common in most parts of the Province. Even in aboriginal times the leathery, evergreen leaves, rounded at the top and tapering at the base, were harvested, dried, and smoked by most of the Interior Indian groups. Later, when commercial tobacco was introduced, kinnikinnick leaves were mixed with it to make it last longer, and its use was adopted by the coastal groups as well.

A number of other wild plants were used for tobacco in areas where smoking was practised -- dried yew needles (*Taxus brevifolia*), red-osier dogwood or red willow bark (*Cornus stolonifera*), and real wild tobacco (*Nicotiana attentuata*), to name a few. Often, smoking ingredients were mixed together.

(3) Licorice Fern (*Polypodium glycyrrhiza*)-This is a small fern which commonly grows on rock faces and tree trunks west of the Coast Mountains. The slender branching rhizomes grow beneath moss and can be easily pried off and cleaned. They have a strong distinctive licorice

flavour. Rather than being eaten in quantity as a food, they are best chewed in small amounts as a condiment and appetizer. Water drunk after chewing them tastes sweet. Children in some coast groups who would not eat were fed small pieces of rhizome until their appetite returned. Other groups used them to flavour Labrador tea. They were used throughout the coast as a cough and sore throat medicine.

(4) "Indian celery" (Lomatium ambiguum, L. triternatum, L. nudicaule)- All of these plants, being in the carrot or celery family, have strongly aromatic seeds and stalks, similar to commercial celery seed, caraway, or lovage. Various Interior Salish groups used the stalks with young seeds attached to cook with meat, potatoes, or "Indian potatoes" (Claytonia lanceolata) in steaming pits. Even today the stalks are added to stews and soups, contributing a very pleasant flavour.

B. Plants as Materials

One has only to look around an average classroom to appreciate the importance of plants in modern technology. Clothing, paper, varnished wooden desks, cords for venetian blinds ... all of these are derived directly or indirectly from plants. In British Columbia Indian societies, plants were even more important as construction and manufacturing materials. Each type of wood, each fibrous stem or root, each kind of bark, was utilized to its best advantage in making the structures and implements necessary for survival. Houses, canoes, boxes, baskets, dishes, clothing, ropes, nets, tools, weapons, and many other items were constructed wholly or partially from plant products. Plants were also used as vegetable dyes, both for decoration and for practical purposes, such as colouring fishnets to make them invisible to fish.

Harvesting plant materials, like harvesting edible plants, can be very harmful to the plants, and should be practised with extreme care and discrimination. For example, removing the bark of a cedar or birch tree may expose the wood to disease and insect infestation, and will decrease the flow of nutrients from the roots and thus weaken the tree. Of course, if the tree is completely girdled, it will be killed immediately. Thus, use of such materials should be as efficient and economical as possible.

Next time you have the opportunity to see Native Indian baskets, mats, or implements, examine them closely and see if you can determine which plant materials were used to make them. You may find that three or four different kinds were involved in construction one item. The tremendous skill and ingenuity needed to make these objects is all but forgotten in many parts of British Columbia, but today many young Native people are relearning the time-honoured techniques of using wild plant materials.

Woods

(1) Western Red Cedar (Thuja plicata)-Red cedar has been called "the cornerstone of culture" of the coastal Indians of British Columbia. The wood, inner bark, roots, and branches were all utilized in Native

technology. The trees attain an enormous size, and the wood is easy to split, yet strong and rot-resistant. It was an ideal material for building the famous dugout canoes of the coastal peoples, as well as house planks, totem poles and house posts. Planks could be split from standing trees with a series of graduated wedges. The culmination of craftsmanship in cedar was in the carved or painted "kerfed" boxes of the Kwakiutl, Haida, and other coastal groups. These were constructed from a single cedar board, grooved, steamed, and folded in three places and sewn with spruce root along the fourth corner to form the sides and fit with a bottom which was also sewn. These boxes were watertight, and could be used for storage of oil, dried foods, or ceremonial objects. Examples can be seen in almost any museum containing Native artifacts.

Cedar branches, or "withes" were split and twisted into ropes of various sizes, to be used as fishing lines, anchor lines, and binding for boxes and bundles.

(2) Red Alder (*Alnus rubra*)-Alder wood is light coloured, even-grained, and easily worked. On the British Columbia coast it was the favourite material for carving dishes. Unlike some woods, it does not impart any unpleasant flavour to the food. This property also made alder wood a popular fuel for smoking meat and fish; it burns well but does not make the food taste bad.

(3) Western Yew (*Taxus brevifolia*)-Yew wood is hard and strong, yet pliable. It was used for making a variety of implements requiring strength and flexibility, such as wedges, adze handles, paddles, digging sticks, bows, and harpoon shafts.

* * * *

Many other types of woods, including maple (*Acer macrophyllum*, *A glabrum*), crabapple (*Pyrus fusca*), oceanspray or ironwood (*Holodiscus discolor*), mock-orange (*Philadelphus lewisii*), and Saskatoon (*Amelanchier alnifolia*), were used by various native groups. Each has special properties which makes it appropriate for specific purposes: maple for paddles and snowshoes, oceanspray and crabapple for digging sticks and handles, and mock-orange and Saskatoon for arrows.

Stem, Bark, and Root Fibres

(1) Western Red Cedar (*Thuja plicata*) and Yellow Cedar (*Chamaecyparis nootkatensis*)-The inner bark of these trees is tough and fibrous. The bark can be pulled off in long strips in spring and early summer. The outer part is broken off, and the inner bark is split into thin sheets, then dried. The coastal Indians used this bark to make clothing, mats, baskets, ropes, and blankets. Yellow cedar bark was considered softer and of higher quality than red cedar bark. Cedar roots, especially in the Interior, were prized as a basket material.

(2) Birch (*Betula papyrifera*)-Birch bark is famous as a material for making baskets and canoes by interior British Columbia and eastern Canadian Native peoples. It can be stripped horizontally off standing trees in sheets ten or more feet in length. It is pliable and waterproof, and can be molded and sewn into beautiful watertight containers. The bark has a natural tendency to curl backwards when taken off the tree, so that

the inside of baskets and canoes is really the outer part of the bark.

(3) Bitter Cherry (*Preunus emarginata*)-Cherry bark is similar to birch bark in that it peels off the tree horizontally. It has a natural red-brown varnished appearance and is excellent for decorating baskets and wrapping the handles of implements. For variety, it can be stained deep black by soaking it in black swamp soil for several months. Have you seen baskets decorated with strips of red and black cherry bark? This type of decoration is called "imbrication".

(4) Sitka Spruce (*Picea sitchensis*)-The Haida and other northern coastal groups are experts at utilizing the long thin roots of spruce for basketry. Spruce root baskets are masterpieces of intricacy and can be woven so tightly that they are watertight. Spruce root also makes very good "string" for sewing wood, such as in making kerfed cedarwood boxes.

(5) Stinging Nettle (*Urtica dioica*)-The mature stems of these plants were harvested, dried, pounded, and twisted until only the tough white fibre remained. This was made into twine for fishnets and for tying bundles of food. Fireweed stem fibre (*Epilobium angustifolium*) was used for the same purpose by some coastal Indian groups, such as Haida.

(6) Indian Hemp (*Apocynum cannibinum*)-The Interior Salish and other interior groups utilized the fibrous stems of this plant for making nets, bags, and mats. Like stinging nettle, the stems were harvested in fall, beaten, and twisted into twine. The famous salmon nets of the people along the Fraser River were made from this material.

"Grasses" and Bulrushes

A variety of "grasses" and grass-like plants were harvested to make baskets and mats in various parts of the Province. Most important among these were the cat-tail (*Typha latifolia*), with flat spongy leaves, tule (*Scirpus acutus*, *S. validus*), with round spongy stems, "basket-grass" (*Carex obnupta*), and bear-grass or squaw-grass (*Xerophyllum tenax*), actually a lily. Cat-tail and tule mats were used as mattresses, kneeling mats, and even tenting for summer houses. Some were well over six feet long. The other "grasses" were used in weaving or decorating baskets.

Dyes

(1) Red Alder (*Alnus rubra*)-The bark of this tree yields a stain ranging from red to orange to brown, depending on how it is extracted. Boiling it in a small amount of water is sufficient to produce enough dye to colour cedar bark, wood or cloth. Cedar bark dyed red was very important as ceremonial decoration for masks and dancing costumes. Fishnets were dyed with alder to make them invisible to fish.

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Several other vegetable dyes were employed by Native peoples, including wolf moss (a lichen, *Letharia vulpina*), and Oregon grape (*Berberis* spp.), both yielding a yellow colour; hemlock (*Tsuga heterophylla*) yielding a brown dye; flowering dogwood (*Cornus nuttailii*), brown to black; blackcap berries (*Rubus leucodermis*), purple; strawberry blite

(Blitum capitatum) (red), and Indian paint fungus (Echinodontium tinctorium) (red). These dyes were used in decorating baskets and face-painting, but mineral dyes such as red ochre were more commonly used to paint wood.

Others

(1) "Indian sandpaper" - Horsetail (Equisetum arvense, E. telmateia)- These plants have silicon impregnated in their cells, making them rough and scratchy. They were used, as was shark or dogfish skin, to smooth over rough wood, just as sandpaper is used today.

(2)"Indian wax-paper" - Skunk Cabbage (Lysichitum americanum)-The large waxy leaves were used for many household tasks, including lining steaming pits, covering berry-drying racks, wrapping fish for cooking, and even making instant drinking cups. They were not eaten themselves, but did not seem to impart any unpleasant flavour to the food they covered.

(3) Bull Kelp (Nereocystis luetkeana)-This long, hollow-stemmed seaweed was used both as fishing line, and as a container, for oil or grease. First it was dried in the sun, then soaked in fresh water and redried so it wouldn't rot. Before it could be used as fishing line, it was resoaked in salt water until pliable.

C. Medicinal Herbs

Literally hundreds of wild plants were used as medicines by Indian peoples in British Columbia. Some were known only within one cultural area, or even within only one village or family, while others were known universally throughout their range. In many cases, the use and preparation of herbs were closely guarded secrets, known only to the Indian doctor or herb specialist performing the cure, and guarded even from the patient and his family. Even today, plant medicines are considered highly important and even sacred, and should never be dealt with lightly or foolishly. Some of them are highly toxic and must be taken with extreme caution or they will cause sickness and even death.

Modern doctors and pharmacologists still have much to learn about Indian medicines. Many are known to contain valuable drugs and chemicals which are finding application in commercial medicinal preparations. Most have yet to be thoroughly analyzed; undoubtedly many more useful drugs will be identified and isolated from Native medicines in the future.

The following are only a few common examples of medicinal herbs in British Columbia. They are intended to demonstrate the variety and complexity of Indian medicines as known and used in the past.

Poultices

Poulticing was a common method for treating skin ailments, cuts, and bruises. The plant would be mashed or bruised and applied directly to the skin over the affected area. Depending on the treatment, it was left on only a few minutes, or covered and left for several days.

(1) Coniferous tree pitch - from species such as Western Hemlock

(*Tsuga heterophylla*), Sitka Spruce (*Picea sitchensis*), Ponderosa Pine (*Pinus ponderosa*), Larch or Tamarack (*Larix occidentalis*), and especially "Balsam" Fir (Grand Fir - *Abies grandis*, and Subalpine Fir - *A. lasiocarpa*). The last two species have swollen pitch blisters beneath the bark of the young trees, yielding large quantities of liquid pitch when broken.

Pitch was considered one of the best healers for burns, scrapes, cuts, splinters, and skin diseases. It was plastered over the skin, alone or mixed with animal fat, and left for several days. If the problem persisted, the treatment was repeated. So many stories of the effectiveness of pitch exist that its medicinal qualities cannot be doubted, and should be thoroughly investigated by modern pharmacists.

(2) Rattlesnake Plantain (*Goodyera oblongifolia*)-The white-marked leaves were split open and the moist inner part placed over cuts to make them heal quickly. Broad-leafed plantain (*Plantago major*) was used in the same way.

(3) Yarrow (*Achillea millefolium*)-The feathery aromatic leaves were crushed and applied to the chest for colds and bronchitis, much in the same way as "Vicks" or camphor is applied today. For sore throats and sinus congestion, the leaves were chewed and the juice swallowed, or a tea made from the leaves was drunk.

(4) Wild Anemone (*Anemone multifida*, *A. patens*)-These flowers, and several others in their family, including buttercups, cause blisters when applied to the skin. For boils, bruises, or muscular pains, the leaves were held to the skin for just a few minutes, and were said to draw out the infection and pain. If left on any longer, they resulted in severe blistering, much like poison ivy.

Fumigants

A number of different aromatic plants were used to purify the air or "deodorize" a house. They protected the inhabitants against evil influences and were used especially during times of death or illness. Some examples are "Rocky Mountain juniper (*Juniperus scopulorum*), Sagebrush (*Artemisia* spp.), and Indian consumption plant seeds (*Lomatium nudicaule*). Thorny or prickly plants, such as wild rose (*Rosa* spp.), thistle (*Cirsium* spp.), Engelmann spruce (*Picea engelmannii*), swamp gooseberry (*Ribes lacustre*), and devil's club (*Oplopanax horridum*) were also considered to have good protective powers. These plants could be burnt in a fireplace, placed on trop of a stove and allowed to smoulder, or simply hung up in the house permanently.

Physic Poisons

Native tradition in British Columbia and elsewhere in North America required that people, such as initiates, hunters, and shamans, who are seeking special powers or favours, be thoroughly clean, not only externally, but internally as well. External cleanliness was attained by frequent bathing and ritual scrubbing, while internal cleanliness was achieved by fasting (not eating for several days) and by taking certain herbs to "clean out the system". Many of these cleansing herbs are violently poisonous, and great care, knowledge, and experience was required to administer just the right dosages. Even properly administered, they would cause vomiting or have strong laxative properties. Some of these poisonous herbs were taken as more conventional medicines as well, for internal disorders, tonics, or for muscular ailments such as rheumatism and arthritis.

Examples of plants which fall into the category of "poisonous medicines" are: Indian hellebore (Veratrum viride) water hemlock (Cicuta douglasii), baneberry (Actaea arguta), ninebark (Physocarpus capitatus), and devil's club (Oplopanax horridus). These medicines should never be taken without full knowledge of the procedures required, or their effects. It is sufficient to point out that a small piece of the root of either Indian hellebore or water hemlock is enough to kill a cow within minutes!

Other Medicines

Many many other medicines were employed by Native peoples, to treat everything from colds to eye infections to toothaches to broken limbs. Like modern medicines, they varied in effectiveness. Often two or more herbs were mixed together for application. Some further examples of medicinal herbs are listed below:

(1) Cascara (Rhamnus purshiana)-The bark of this tree is a well known laxative. It is used in some of the modern commerical laxative preparations, and during the Second World War was harvested to such an extent that cascara trees were virtually eliminated in some areas. British Columbia Indians have been using this medicine for centuries.

(2) Oregon Grape (Berberis spp.)-The Okanagan Indians and others made an eye medicine out of the bark of this shrub. Today it is used commercially as an eye medicine in "Murine" eye drops.

(3) Soapberry (Shepherdia canadensis)-The berries are said to be a "health" food, as well as a pleasant dessert, and are known to have a high iron and vitamin content. The branches were boiled by the Interior Salish and others to make a tea for several different ailments, including high blood pressure, stomach troubles, heart disease, and constipation.

(4) Stinging Nettle (Urtica dioica)- For sore or stiff muscles, arthritis, rheumatism, or paralysis; the limbs can be rubbed with nettle leaves. This causes temporary pain and swelling, but in many well documented instances it has cured the ailment within a few days.

D. Plants in Native Religion and Folk-Lore

Indian peoples have had a traditional reverence for life, which modern society would do well to imitate. In the old days, not only animals, but plants, and even rocks, were considered to have "souls", and to be capable of thought and feeling just as people are today. The need to utilize and exploit these natural objects was recognized, but they were always approached with reverence and respect and were never used wastefully or without appreciation. A good example of the type of respect given to a plant can be seen in the following "prayer" by a Kwakiutl woman to a young cedar tree from which she is about to harvest the bark. (Bous, 1930: The Religion of the Kwakiutl Indians)

PRAYER TO A YOUNG CEDAR

The woman goes into the woods to look for young cedar trees. As soon as she finds them, she picks out one that has no twists in the bark, and whose bark is not thick. She takes her hand adze and stands under the young cedar trees, and looking up to it, she prays, saying:

Look at me, friend!
I come to ask for your dress,
For you have come to take pity on us;
For there is nothing for which you cannot be used, ...

For you are really willing to give us your dress,
I come to beg you for this,
Long-Life maker,
For I am going to make a basket for lily-roots out of you.

I pray, friend, not to feel angry
On Account of what I am going to do to you;
And I beg you friend, to tell our friends about what I ask of you!

Take care friend!
Keep sickness away from me,
So that I may not be killed by sickness or in war,
  O friend!

Most legends of B.C. Indians feature animals, but plants were also frequently involved, particularly in the stories about Raven or Coyote These two figures -- Raven on the Coast, and Coyote in the Interior -- travelled around the country when the world was still young and used their powers to change animals, plants and natural features to their present state of form, in preparation for the coming of human beings. Some example of Raven and Coyote stories involving plants are provided below.

RAVEN AND THE ORIGIN OF SOAPBERRIES AT BELLA COOLA (from McIlwraith, 1948: The Bella Coola Indians

Long, long ago, there was a mountain in Carrier country about Burnt Bridge, who was a chief. Buffalo berries (soapberries - nuxski) flourished on his slopes, and he wanted to keep these for food for his guests. On one occasion, he invited all the animals and birds, including Raven to a feast and dance. His house was the interior of the mountain and when all had assembled, he carefully closed every opening so that none of the berries could escape. Raven determined to obtain some of this food for the Bella Coola and accordingly used his power to force one of the guests to go outside. As soon as the door was opened to let him out, Raven seized some of the "whip" and flew away scattering drops of it in his flight. Berries grew everywhere where the drops fell and since that time, everybody has been able to make this luxury. The Chief was very angry, but he could do nothing about it.

(NOTE for a description of how soapberries are eaten, see Section I on Wild Plant Foods, under Berries and Other Fruits.)

RAVEN KILLS PITCH-MAN (from Teit, 1919: Tahltan Tales, Journal of American Folk-Lore, Vol. 33, No. 124)

Now Raven came to the house of Pitch-Man, who was the only person who knew how to catch halibut. He owned a halibut-hook, which he kept hidden. The people did not know how to make halibut-hooks. Raven said to the man, "I will help you with any work you have to do." He agreed, and Raven did a great deal of work for him. Raven noticed that he always went to a cool shady place when the sun rose or when it was warm weather. He slept in the shade all day, and in the cool of the evening he went fishing. He always returned from fishing before sunrise. One day Raven said to him, "I will help you fish." They went to sea, and Raven steered the canoe. Pitch-Man fished, and always kept his hook in such a position that Raven could not see it. They fished all night. When daylight came, the man wanted to go home; but Raven refused, saying that they had not caught enough halibut. Shortly before sunrise he told Raven that they must go home, and he looked anxiously in the direction where the sun would rise. Raven said, "We will go soon, we will catch just a few more fish."

They continued fishing. Presently the man became sleepy, and was hardly able to talk. At last he fell sound asleep. The sun rose, and the wind quieted down, and it became very hot. Then Raven saw that the man had melted. Raven went home, took the melted pitch, and threw it to the trees, saying, "Henceforth pitch will be found in the wood of trees." Now he examined Pitch-Man's hook, showed it to the people, and they copied it. After this people had halibut-hooks and could catch halibut.

HOW COYOTE HAPPENED TO MAKE THE BLACK MOSS FOOD (an Okanagan myth from Coyote Stories by Mourning Dove, 1933)

(NOTE: The original version has been abridged and simplified for purposes of this unit)

Coyote and his son, Top-kan were travelling. After trying in vain to capture beavers to eat, they came to many white swans resting in the water of a large lake. The swans wanted to trick Coyote, so they let him swim out and catch two of them and pretended to be dead. Coyote tied them to Top-kan, then climbed a pine tree to get the pitch-top where Porcupine had gnawed. He wanted the pitch-top for fire-kindling.

Just as he got to the top of the tree, Coyote heard his son crying. He looked down and saw the swans flapping their wings. They were starting to fly. Coyote jumped, but his long hair braid caught on a branch of the pine tree and did not come loose. Coyote swung there, helpless. He could not untangle his hair.

The swans flew past the tree, past Coyote, and up into the sky. Dangling beneath them, tied to them by the thongs, was little Top-kan. When the swans were high in the air they cut the thongs, and Top-kan fell to the ground and was killed. Then Coyote took his flint knife and chopped off his hair braid, and dropped to the earth. He looked up at this hair hanging from the branch.

"You shall not be wasted, my valuable hair. After this you shall be gathered by the people. The old women will make you into food," he said.

That was Coyote's ruling near the Beginning. That is why his hair, the long black timber-hair, hangs from the trees in the mountains. It is called skwellip. It is the black moss that the people cook in pit-ovens.

Top-kan did not stay dead. Coyote restored him to life by stepping over his body three times. Then they returned to their country.

(NOTE: the "black moss" reffered to in this story is actually a lichen, *Alectoria jubata*, whose use as food is described in Section 1, Wild Plant Foods, under Green Vegetables.)

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- Scagel, R.F. (1967). Guide to Common Seaweeds of British Columbia. British Columbia Provincial Museum Handbook No. 27, Victoria, B.C. (Slightly technical, but well illustrated and thorough, with a good introduction.)

- Szczawinski, A.F. (1962). The Heather Family (Ericaceae) of British Columbia. British Columbia Provincial Museum Handbook No. 19, Victoria, B.C. (Excellent reference book for this family; contains line illustrations and distribution maps.)

- Taylor, T.M.C. (1956). The Ferns and Fern-allies of British Columbia. British Columbia Provincial Museum Handbook No. 12, Victoria, B.C. (Excellent reference book with illustrations.)

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III. EDIBLE, USEFUL, AND POISONOUS PLANTS OF COASTAL BRITISH COLUMBIA AND ADJACENT AREAS

- Anderson, J.R. (1925). Trees and Shrubs, Food, Medicinal, and Poisonous Plants of British Columbia. King's Printers, Victoria, B.C. (Out of print, but obtainable at many libraries; contains much useful and original information.)

- French, D.H. (1965). Ethnobotany of the Pacific Northwest Indians. Economic Botany, Volume 19, No. 4: pp. 378 - 382. (Very general; mostly applicable to American Indian groups.)

- Gunther, E. (1945). Ethnobotany of Western Washington. University of Washington Publications in Anthropology, Volume 10, No. 1. University of Washington Press, Seattle, Washington. (extremely detailed for Western Washington groups; contains original information.)

- Kingsbury, J.M. (1964). Poisonous Plants of the United States and Canada. Prentice-Hall, Inc., Englewood Cliffs, New Jersey. (A rather technical but highly informative account of poisonous plants and their products, especially in relation to livestock poisoning.)

- Kirk, D.R. (1970). Wild Edible Plants of the Western United States. Naturegraph Publishers, Healdsburg, Calif. (Includes many plants of the B.C. coast, with botanical descriptions and illustrations.)

- Smith, H.I. (1928). Materia Medica of the Bella Coola and Neighbouring tribes of British Columbia. National Museum of Canada Bulletin, No. 56, King's Printers, Ottawa, Ont., pp. 47 - 68. (Restricted to medicinal plants, but very interesting.)

- Sweet, M. (1962). Common Edible and Useful Plants of the West. Naturegraph Publishers, Healdsburg, Calif. (Illustrated: includes a number of plants of the B.C. coast.)

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- Szczawinski, A.F. & Hardy, G.A. (1971). Guide to Common Edible Plants of British Columbia. British Columbia Provincial Museum Handbook No. 20, Victoria, B.C. (An excellent general reference; well illustrated.)

- Turner, N. (1973). The Ethnobotany of the Bella Coola Indians of British Columbia. Syesis, Volume 6: pp. 193 - 220.

- Turner, N. & Bell, M.A.M. (1971). The Ethnobotany of the Coast Salish Indians of Vancouver Island. Economic Botany, Volume 25, No. 1: pp. 63 - 104.

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- Turner, N. & Taylor, R.L. (1972). A review of the Northwest Coast Tobacco Mystery. Syesis, Volume 5: pp. 249 - 257. (A discussion of the tobacco cultivated by the Haida and Tlingit Indians.)

- Carrier Linguistic Committee (1973). Hanuyeh Ghun Utni-i: Plants of Carrier Country. Carrier Linguistic Committee, Box 928, Ft. St. James, British Columbia.

- Indian Herbal Remedies Project (1973). Indian Herbal Remedies. (A pamphlet produced under the auspices of the Opportunities for Youth Programme, Vancouver, B. C.)

- Surtees, Ursula (1974). Lak-la Hai-ee (Shuswap Indian meaning "to tell".) Vol. 1. Interior Salish Food Preparation. Handled by the Kelowna Museum, Kelowna, B. C.

UNIT VI

Suggested Activities in Physical Sciences

Willard A. Brown

Editor's note:

If the activities suggested in this unit are to be presented to students on the basis of relevance to Native Indian culture, then the teacher should find out what practices in the present Native Indian community can be correlated with these activities. The Native Indian community may even be faced with problems that can be solved or alleviated by measures which involve scientific principles presented in these activities. These activities are based on emerging technological activities observed in a Native Indian community.

UNIT VI

Suggested Activities in Physical Sciences

It is fairly common knowledge that people in many professions need a knowledge of the physical sciences. Physicians, nurses, dentists, engineers, airline pilots, architects, military officers, and many others all daily need, at least at the intuitive level, an understanding of concepts from the physical sciences. Too few, however, realize that general knowledge in the physical sciences is needed for doing a good job by many in the so called "blue collar" occupations. Examples of these occupations are auto mechanic, fisherman, farmer, aquaculture worker, logger, truck driver and others.

In this unit will be found a number of experiences that illustrate physical science related problems that show up in these "blue collar" occupations. No attempt is made to exclude experiences that include biological concepts since practical problems are usually of a mixed nature.

Water is a very effective solvent. Sea water is not only a solvent, but has in solution, many chemicals and bacteria that attack various materials.

Marine life, fish, clams, crabs, etc., are very sensitive to the character of the water in which they live. So are marine plants. Some of the following experiences should help students understand some of the problems and their answers associated with aquaculture.

Activity I: Natural Pollution

From the sink faucet obtain a sample of water in a clean glass container. Rinse the container out several times before taking the sample. Some soap left on the surface of the glass could completely invalidate your study. Using a kit made for measuring the acidity of fish tank water find out whether this water is acid, base or neutral.

(a) If the water is basic, add sodium biphosphate to make it slightly acid. Follow the directions in the kit.

(b) If the water is quite acid add sodium bicarbonate to make it only slightly acid. Again be careful to follow directions.

Let the water set overnight and try the test again. Now put some clam or oyster shells, or lime rock in the water and leave alone for several days. Again check the water to see if it is basic, acidic or neutral. In all likelyhood it will be basic. Thus the clam or oyster shells or the lime rock can be considered a pollutant where acid loving fish are concerned. Fish that require basic water of course will be adversely affected by the presence of such material as phosphate rocks. More important, they are quite sensitive to sudden changes of acidity.

Activity II: Effect of Pollutants on Marine Life

Fish are also quite sensitive to the presence of certain metals such as iron, mercury, copper, zinc and cadmium. Fresh water will be adversely affected by these metals fairly slowly but sea water will react to them rapidly.

To observe the action of sea water on metals, two demonstrations can be set up.

(a) In a glass container place some bare copper wire, iron wire, and a zinc coated nail. File a bit of the zinc on the nail so as to expose the iron below. Fill the container with sea water and leave for a month. Periodically observe the water and metals making note of any changes. Add fresh water as needed to keep the volume reasonably constant.

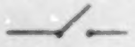
(b) Obtain a tubular aerator made for tropical fish tanks and use this to bubble air through another container of sea water. Slightly above the sea water suspend some metal objects. Let the system operate for a week or two and observe the effect on the metal pieces.

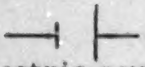
A discussion regarding the importance of keeping garbage from our seashore could be useful after this experience.

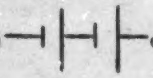
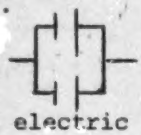
Fluorescent lamps often have end caps of metal coated with zinc or cadmium. These lamps are frequently used to give artificial sunlight in aquaculture and if not protected by a plastic or glass cover the water from the tanks will splash up on the end caps dissolving a little at a time the zinc or cadmium. Mines are also a source of such pollutants. The students should make inquiries about other sources of such pollutants. Structural steel, iron grates, chains, concrete piers are all weakened gradually by contact with sea water. What can be done to reduce such damage?

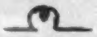
Activity III: Batteries and Bulbs

In almost any occupation one needs a simple understanding of electricity. This experience should give a beginning of such understanding. You will need two fresh "D" cells and two not so fresh ones. Preferably the latter should just barely make a number 222 bulb glow. The following symbols and their meanings are needed.

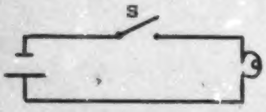
(a)  switch. Note that for a switch the meaning of the words "closed and open" are opposite to what they imply for water faucets and other valves. A closed switch allows a continuous metallic circuit and thus an electric current can pass through while a closed faucet does not allow flow of water.

(b)  a single "D" cell or other source of direct current electric power.

(c)  or  a "battery" of cells

(d)  an electric lamp such as #222 or #48.

Construct the following circuits. Test each by opening and closing the switches or removing and installing the lamps in as many combinations as possible and try to explain the results. Also substitute the used cells for the fresh ones.

A


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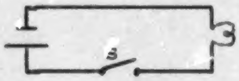

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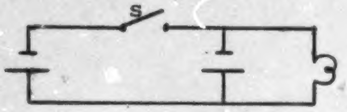
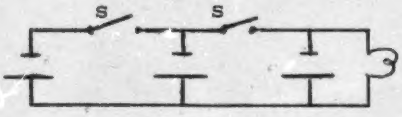
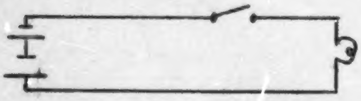
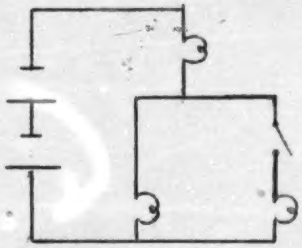
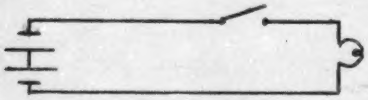


D


E


F


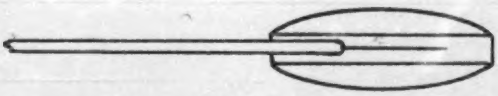
G


The circuit "F" will be an excellent source for a class discussion concerning what goes on.

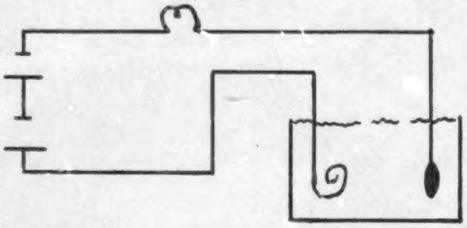
Activity IV: Protection of Metals From the Chemical Action

There are several ways to protect metals from the chemical action of sea water or from the chemicals in most soil. One of course is to use a paint. The trouble with this method is that the paint is easily broken. Another method uses an electric current.

Make an electric wet cell by the following means. Bare both ends of a copper wire and insert one into a split fishing sinker and crimp the latter with pliers.



Connect another piece of wire to a zinc or magnesium strip. Connect the free ends of the two wires to a #222 bulb and immerse the magnesium (or zinc) and sinker in a cup of chlorine bleach. The bulb should glow lightly. At the same time the magnesium or zinc will gradually disappear. Now connect two "D" cells in series and insert them in the circuit as follows.



Use a fresh piece of magnesium and check whether it is eaten away by the chemical action.

Underground fuel tanks and pipes are frequently protected in this way and so are metallic parts of boats that are exposed to sea water. Very often though a slightly different though related method is used in boats. A zinc plate is attached to the hull and electrically connected to the engine and propeller shaft. Iron and brass immersed in sea water produce an electric current. Have a class discussion on how this would be useful.

Activity V: Effect of Salt Content on Freezing Points of Water

Water temperature is an important part of the environment of marine life, just as air temperature is important to the health of an orchard. Some fish are killed by temperature below 32°F or 0°C. The lack of ice present cannot be used as a safe guide in the case of salt water organisms. The following experience will illustrate this.

When ice and water exist together in the same volume the temperature will remain constant so long as some of both are present. Of course this will appear to be not true for a short while when they are first put together if one is a different temperature from the other before mixing. Eventually though they reach an "equilibrium" temperature which depends upon the amount of salt dissolved in the water. To illustrate this fact add ice cubes or ice chips to several containers of water; one pure and the others with various measured amounts of salt dissolved. Measure the temperature of each mixture after waiting 10 minutes. Discuss the implications of your observations for raising fish that require a minimum temperature of 32°F. The containers of ice water should develop a coating of water or frost on them. Pipes that are used to circulate cold water will do the same thing. How can this be eliminated?

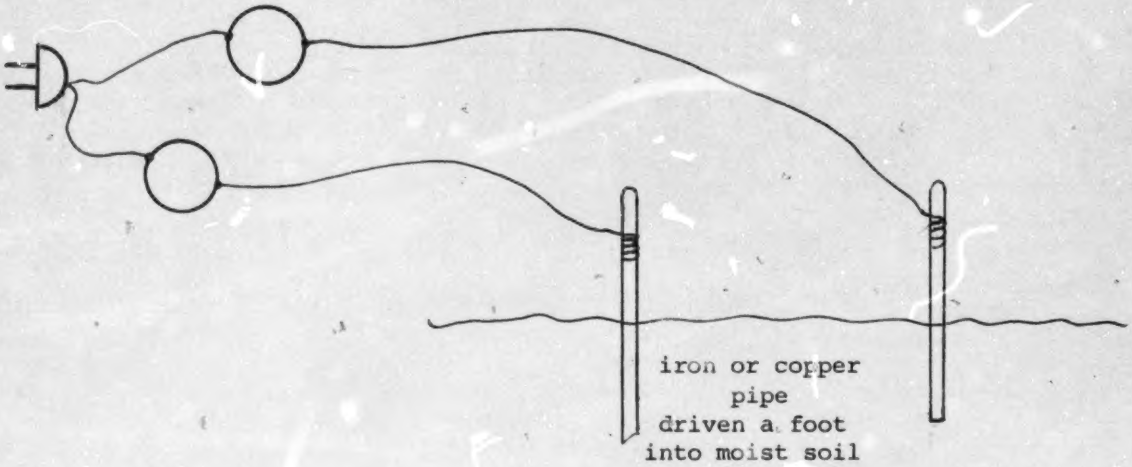
Activity VI: Interaction of Sea Water With Metals

Sea water and soil contain various salts including sodium chloride. These salts interact with metals that are in contact with each other and with the water or soil. A demonstration of the kind of action that can occur is given by the following activity.

Place four dry cells in series and connect copper wires to them. Put the other ends of the copper wire into some salt water. Make note of the appearance of the salt solution and the shape of the wires before and after the reaction starts.

Find out what has happened to the salt solution and to the copper wire. The reaction will take a while. You might try using a toy train transformer instead of a battery and note the difference. (Note: an HO train power supply gives direct current and would give the same result as the battery.)

Activity VII: How to Tickle Worms?



Earth worms will be caused to come to the surface by this set up. Have a class discussion -- how, why, is it cruel? If both lamps do not glow with the same brightness try to find out why. Note that care needs to be taken with this set up so that you do not come into contact with the metal parts when the plug is in a power outlet.

Activity VIII: Setting up an Aquarium

Set up an aquarium tank using an underground filter. Discuss in class how the air bubbles rising in the tube pump the water from under the gravel.

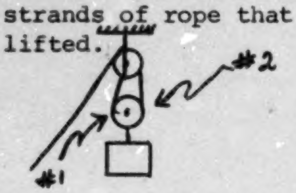
Activity IX: Flotation of Materials

It is interesting that floating docks and even ships can be made of concrete. Artificial clay (plasticene) is an excellent material to use in demonstrating flotation of materials denser than water.

Completely cover a match box with plasticene and then put it in water. Try explaining why it floats. Next try making small boats of the plasticene. See who can make a boat that supports the largest number of paper clips. Each student should be given the same weight of plasticene.

Activity X: Block and Tackle - A Pulley System

Lifting heavy weights is frequently involved even in skilled trades. A block and tackle is an important tool necessary for the safety of the worker. In block and tackle the important feature is the number of strands of rope that actually are physically supporting the object to be lifted.



Two strands support the weight, thus the force you exert is one-half the weight of the object lifted.

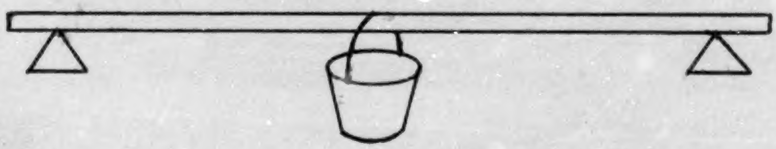
In the above example two strands of rope physically support the object to be lifted. Obtain a real block and tackle such as frequently used by hunters to lift a moose carcass for cleaning and skinning. Change the number of strands of rope supporting a weight and see how this affects the force you have to exert.

Activity XI - Proper Use of Materials in Supporting Weight

Different materials have different abilities to support weight. Your safety in work depends on proper use of materials.

(a) Set up two buckets, one supported by a number 16 copper wire and the other by a number 16 iron wire. Add sand, a pound at a time, to both buckets recording the height from the floor of the buckets each time, to both buckets recording the height from the floor of the buckets each time. Which metal is the stronger?

(b) Obtain 1" x 4" boards 6 feet long, one each of Hemlock, Cedar, Fir and Pine. Support each, one inch in from the end and have each support a bucket by its handle. Use the same procedure as above. Have a discussion on the importance of using the kind of wood specified by engineers and architects.



Activity XII: Guest Speaker (Demonstration)

Invite a repairman of small gasoline engines, such as are used in lawn mowers, to bring to class a four stroke cycle engine and take it apart -- explain the function of all parts and put it back together.

Activity XIII: Dry Cell Economy

Buy two samples each of the cheapest and the most expensive carbon-zinc "D" size dry cells and two of the same size "Alkaline" cells. You will also need six number 222 bulbs. Connect each cell to a lamp bulb for half an hour at a time with at least two hours rest time in-between connected times. Keep track of the time for each cell and make note of how bright the lamp bulb shines. You could use a third alkaline cell and lamp that is used for only a couple of minutes at a time as a comparison standard. When the lamps are noticeably dimmer make special note of that fact.

Make a decision regarding the useable life for each of the different kinds of cell, then decide what the cost per hour is for each kind. Do the cells live up to the manufacturer's claims?

Activity XIV: Lamp Bulb Economy

The manufacturers of house-hold lamp bulbs are now showing the life expectancy for their product on the carton. A typical life expectancy is 1000 hours. Set up a circuit for lighting three lamps of the same wattage rating (for instance 40 watts.) Record the date and hour that the test is started and let the lamps run day and night until they burn out. How many days should they burn?

If a bulb burns out during the night, when you are not there to record the time, how much error will be involved in your data and conclusions? Try the same experiment with some lamp bulbs for which the life time is not stated.

How much did the test cost?

Be sure to start this test early in the school year.

Activity XV: Electric Motors

Request of a local electric motor repair shop that they bring to the class, examples of the following kinds of electric motors: split phase, capacitor start, repulsion induction, 3 phase, universal, direct current.

The characteristics, care and special uses of each should be explained. If reasonable each type should be taken apart, the parts identified, and then reassembled.

Activity XVI: Fire Control

Ask the local fire department to give a demonstration of the proper uses and care of various fire extinguishing equipment. Actual (out-of-doors) fires should be used. Stress should be made regarding techniques to be used when electrical equipment might be involved or closed spaces have to be entered.

Pollution from fires and fire control should be dealt with.

Activity XVII: The Syphon - A Tool

Emptying a large container of water can be difficult if not dangerous or messy. An excellent means of demonstrating the utility of a syphon is to empty a large wading pool or other large container with and without a syphon. First try tipping the pool. Then attach a garden hose to a faucet with the other end in the pool. Let the water run slowly until all air is out of the hose. One student should be ready to put his thumb over the end of the hose as the water is shut off. Remove the hose from the faucet and carry that end to lower ground. Keep the other end in the pool and have the student remove his thumb from the end of the hose. The pool should easily be emptied. Try this with some air in the hose. Explain what happens.

CHAPTER VII

EXAMINATION AND EVALUATION SYSTEM IN SCIENCE EDUCATION FOR NATIVE INDIAN STUDENTS - A NEW APPROACH

UNIT VII

Science is Fun

CONTENT

A. Christmas and Easter Chemical Demonstrations

B. Role of Science in the National Economy of Our Country

C. Science Fair - Major Emphasis on Native Indian Contributions to Our Modern World

REFERENCES

- H.N. Alyea and F.B. Dutton, Tested Demonstrations in Chemistry (Arizona: Journal of Chemical Education publication)
- H.L. Sibley, Christmas Demonstrations, CHEM 13 News, December, 1972

A. Christmas and Easter Chemical Demonstrations

(1) CHRISTMAS DEMONSTRATIONS

(i) Christmas Cracker Deluxe:

Equipment:

1 ring stand c̄ ring (small)
1 large metal container
(such as roasting pan)
1 pair of goggles, or
protective glasses
5 ml glycerine
1 asbestos sheet 3' x 3'
1 paper cup
1 graduated cylinder
1 glass stirring rod
10 grams potassium
permanganate

Precautions:

(1) Goggles.
(2) Avoid spilling or touching potassium permangante - it stains hands and clothes.
(3) Keep all students six feet away. They won't miss a thing except the fallout.
(4).Have room well ventilated.

Method:

(1) Assemble stand and ring. Place in roaster.
(2) Put asbestos sheet on table.
(3) Put roaster in the middle. Put cup in ring.
(4) Measure potassium permanganate and put in cup.
(5) Measure glycerine and add to potassium permanganate.
(6) Stir briefly c̄ glass rod - until mixed.
(7) Stand back!!

(ii) Christmas Cake

Equipment:

½ cup granulated sugar
1 beaker (100 ml)
1 sheet of asbestos at
least one foot square
50 ml concentrated sulfuric
acid
1 - 100 ml graduated cylinder
goggles or protective glasses

Precautions:

(1) Goggles
(2) Use extreme caution in measuring and pouring acid.
(3) Have all students at least six feet away.
(4) Allow 'cake' to cool at completion of demonstration, and put in incinerator with due caution.

Method:

(1) Measure sugar into beaker.
(2) Place beaker in middle of asbestos.
(3) Slowly, pour acid into sugar.
(4). Stand back, and watch the 'cake'rise.

(iii) Vesuvius

Equipment:

1 ring stand c̄ ring
1 asbestos gauze square

1 evaporating dish	1 Bunsen burner
Newspaper to cover 3'x3' square	foil to cover newspaper
1 pair of protective goggles or glasses	ammonium dichromate (15 grams depending on size of evaporating dish)

Precautions:

(1) Goggles.
(2) Good ventilation.
(3) No student within six feet.

Method:

(1) Cover table $\bar{c}$ newspaper, then foil.
(2) Place ring stand assembly in the middle.
(3) Put asbestos gauze on ring.
(4) Put measured amount of ammonium dichromate in evaporating dish. Place on asbestos gauze.
(5) Light bunsen burner.
(6) Put on goggles.
(7) Hold burner under gauze, moving it to heat all portions.
(8) When the action starts, remove burner, turn off gas, and stand back to enjoy the show.

(iv) Christmas Mobile From the Kitchen

Equipment:

2 tall, fat beer glasses	tap water to fill
white vinegar three teaspoons per glass	baking soda
red food coloring	6 mothballs per glass
1 tablespoon	green food coloring

Method:

(1) Fill glasses with water.
(2) Slowly stir at least three teaspoons of vinegar into each glass, then two teaspoons of baking soda.
(3) Drop six mothballs into each glass.
(4) Add vegetable dye.
(5) Balls will first sink then one after another, begin bouncing up and down.

(2) EASTER DEMONSTRATIONS

(i) Color TV (Old Nassau Experiment)

Equipment:

(1) Solution A - 15 g of potassium iodate in 1,000 ml of water.
(2) Solution B - 4 g of soluble starch in 500 ml of boiling water.
(3) Solution C - 3 g of mercuric chloride ($HgCl_2$) in 1,000 ml of water.
(4) Ring stand assembly, asbestos gauze, and Bunsen burner.

Method:

(1) Make Solutions A and C.

(2) For Solution B, make a starch paste in a small amount of cold water. Heat the water in a beaker over a Bunsen burner. As it nears boiling, add the starch. Boil a minute then remove flame. Cool.

(3) At the time of the demonstration, mix equal amounts of solution B, C, and A, in that order in a 500 ml beaker. The solution will first turn bright orange, then blue-black.

(ii) Blushing Rose

Equipment:

1 - ½" paint brush
solution of phenolphthalein
1 tack board
1 sponge
1 - 1" paint brush
50 ml (Denatured) ethyl alcohol
200 ml ammonia solution
50 ml water

Method:

(1) Before class, have a student draw the outline of a rose (about 18"). Mount on tack board.

(2) With appropriate brushes, paint the rose c̄ phenolphthalein, alcohol, water mixture. Alow to dry.

(3) Just before the demonstration, dampen the rose lightly - a very fine spray works well.

(4) Have a sponge out of sight soaking in ammonia.

(5) Squeeze out sponge, and hold near the painted rose. When the ammonia has evaporated, the blush will disappear.

B. Role of Science in Our National Economy

Material: Charts on national economy of Canada
Procedure: Seminar

Ask a social studies teacher to explain the national economy of Canada, emphasizing the name and nature of substances and goods manufactured, imported and exported. Also discuss the development of scientific industry in Canada and the use of its products in local industry or in agriculture.

C. Science Fair

Arrange a science fair and arrange for the involvement of the local community. Major emphasis should be placed on Native Indian contributions to our modern world. The following display may be made with the co-operation of Native Indian people.

(1) Native dyes and natural dyeing
(2) Modern dyeing techniques
(3) Production of yarn and thread

(4) The Indian way of life - a scientific study of environment
(5) The equipment available in a science lab. (Display of science experiments should be put on by the students. The demonstrations should be mainly concerned with the applications of science in the community life).
(6) The Chemistry of building materials (The students should exhibit the common substances used in building materials; e.g., cement, lime and plaster)
(7) Charts of balanced diets and pictures of rats or persons showing physical damage due to eating poor diet.
(8) Soap manufacture (Have the students prepare a sample of soap by heating animal and vegetable fats or oil in a boiling solution of sodium hydroxide)

SUMMARY QUESTIONS

The students are required to review all the units they have discussed before and a discussion type exam would be taken to find out how much they can apply the knowledge of science in their daily life. For evaluation refer to Chapter VII.

The students may be given a written exam which should be mainly concerned with applications of science in their daily lives.

CHAPTER VII

Examination and Evaluation System in Science Education For Native Indian Students - A New Approach[27,28]

Our present system of grade placement of students, although based on the concept of maturation level, in effect does not agree with the application of what might be learned from research. Chronological age does not always correspond to mental age. Thus many students with different interests who are taught in the science class by the same methods and offered the same science content are neither ready to understand the material nor ready to retain more complex forms of learning. The above problem is aggrevated by our grade placement curve which is sometimes termed classified "The Normal Curve" or "Bell Shaped Curve." The problem of evaluating Native Indian students to even more complicated because they are generally not interested in the material offered in the present science course. Their attempts usually result in failure and frustration. Satisfaction will come from success, and success will result when interest is aroused.

In order to help create the feeling of success in the Native Indian students, we have to change the present system of evaluation. Instead of giving a D or E for poor achievement, the Science teacher should give extra help or time and design evaluation to help them attain more sub-goals which lead to mastery.

Education should be more nearly a source of pleasure to these students than a source of pain, instilling in them a desire to learn under guidance from a qualified, interested and humane teacher. This does not necessarily mean making education easier, however. It means, rather, that the threat of failure should be reduced, and motivation increased. In the experience of this author, the threat of failure has been observed to have a negative effect on the pupil. The threat results in a dislike for the subject. On the other hand success is more likely to result when interest is aroused. The development of interest - - - motivating the students to do quality work - - - should be the responsibility of the teacher. Clearly, teachers should increase their attempts to motivate pupils by making their teaching more interesting and meaningful. Teaching and learning aimed solely at passing the exam and getting a credit in the course is not likely to be either interesting or meaningful.

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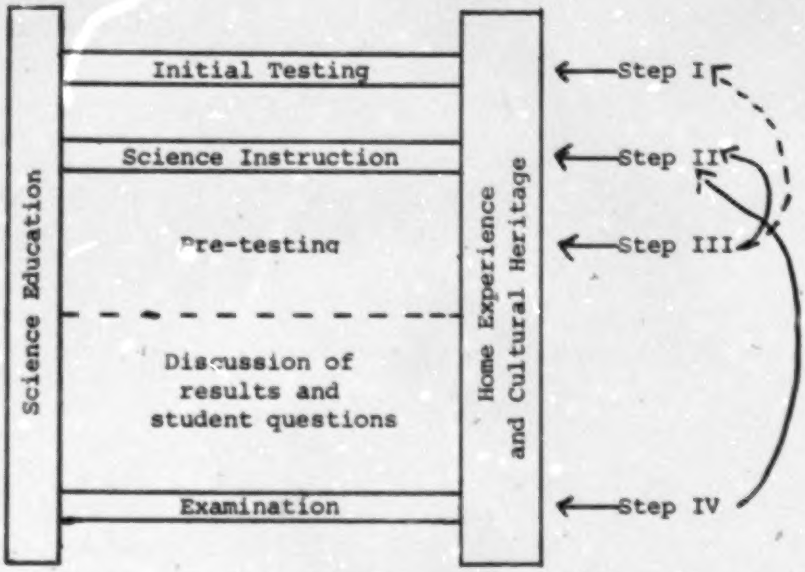
[27] R.M. Kalra, New Directions for Imparting Meaningful Science Education to North American Indian Students, Innovations In Teaching, 1970 - 71, (Hilroy Fellowship Project), pp. 39 - 41.

[28] R.M. Kalra and M.H. Bruce, "Examination and Evaluation System in Science Education - A New Approach", Journal of Indian Educational Review, January, 1973.

Thus, in order to make evaluation an important teaching tool and ensure feed back on students' achievement, teaching and evaluation must be integrated. The teacher may exercise a planned series of evaluative steps instead of a few exams. The following schematic representation (No. II) summarizes such a series of evaluative steps that make evaluation an integral part of teaching, and which are applicable to the proposed general science course for the Native Indian students (refer to Chapter IV).


Science Education
Initial Testing
Science Instruction
Pre-testing
Discussion of results and student questions
Examination
Home Experience and Cultural Heritage
Step I
Step II
Step III
Step IV

Schematic Representation No. II: An evaluation sequence which recognizes different degrees of cultural background and degrees of science proficiency.

The above suggested procedure is composed of the following steps:

Step I: Initial Testing

The tests are designed to find out the previous level of achievement in science. If a science teacher is aware of the previous science background of the Native Indian students, he would be able to develop an individual program of studies designed to correct deficiencies and satisfy the needs according to the ability of the student.

Step II: Science Instruction

Although the purpose of this project is not a detailed discussion of instructional methods, it would be quite relevant here to mention that some modifications in instructional methods are essential to provide a sense of accomplishment and responsibility in the students. In order to allow for varying degrees of individualization, the contract method has been found to be helpful in a variety of situations. From the very beginning, the student is made aware of the fact that the amount of work he accomplishes would determine his grades. The student agrees, in the contract, to complete a specified amount of work according to his own abilities. There would be regular consultations with the teacher, and later an exam which the student is required to pass. Thus, he is assured that he will receive the desired grade if he completes the work. The contract system is not a rigid method of instruction, as it allows flexibility to consider unforeseen limitations. For example, if for some honest reasons a student is incapable of completing his contract, a new contract can be negotiated.

Step III: Pre-testing

After imparting instructions on certain scientific concepts, for example, Physical and Chemical Changes, the science teacher should have a "Pre-test." The purpose of this test is to find out the concepts which have not been properly understood by the students. Furthermore, the students are asked to hand in questions for discussions and for use in quizzes. The students may use any format they wish - objective type, semi-objective type, fill in the blanks, or programmed type. These questions and the students' participation in these discussions are also considered a part of evaluation.

Step IV: Examination

The exam consists of quizzes based on programmed as well as semi-objective type questions. The students will be asked to take a quiz on each of the science units or text book chapters as they occur. In order to take quizzes on subsequent chapters or units, the student must pass the quiz on the preceding chapter or unit (retaking of quizzes should be minimized, however, by the use of the pre-test the students may take each quiz as many times as is necessary to pass it.) However, as an incentive, liberal time limits for the passing of these units should be set by the teacher.

After passing a quiz or exam, the student returns to Step I or Step II, as needed and thus the complete process can be recycled. The "recycling" can also serve as the diagnostic initial testing for the next topic and the recycling goes to Step II instead of Step I. Another recycling arrow implies the return to Step II from Step III if the pre-test indicates the need of further instructions. This method of evaluation takes into consideration the fact that some of the brilliant students may complete the examination in less than prescribed time. Extra enrichment activities should be provided for those students who complete the examination earlier. In these activities, the students should be encouraged to initiate experiments on any science project relating to the application of the scientific principles to the community or reserve life. Motivation for these activities may arise from the students' immediate and basic needs to know and try new ideas. In these activities, the student becomes self directive.

As teachers of science, we must provide our students with an opportunity to see science as a creative and a novel process. If additional activities or experiments are not feasible, the science teacher may give some challenging assignments relating to the community life. An extra credit should be given for this additional effort.

The above system of evaluation incorporates the concepts of individualization which makes it easier to help solve individual problems.

The Suggestions in Use:

The author has secured very encouraging results from implementing the procedures suggested above (Schematics I, II, and III), while working with Native Indian children. The student's increased progress and interest in the subject were quite evident in the example that follows.

This informal study was undertaken with the following specific objectives: To compare students' attainment when using a traditional evaluation system with that when using the authors' suggested system. The study was carried out at Mission Secondary School, Mission, B.C., Canada, during the academic years 1969-71. The population of students included classes of general science and senior chemistry totalling 252, grouped as shown in the following tables. The formal instruction imparted in each subject was the same for each year, and the evaluative criteria utilized for testing were the same both across classes and from year to year. The students were indigenous American Indians, truly a culturally different population when compared to the general population of Canadian students.

The achievement scores noted in the following tables comprise written quizzes and other factors as indicated in Schematic II. No cumulative effect of the use of the suggested system is involved since no students in the general science groups had reached the chemistry classes during the course of the study.

TABLE I
(1970 - 71)

Results with the Traditional System of Evaluation

			Achievement			
Characteristics	Categories	No. of Students	E'	G'	S'	U'
General Science	A_1-up to 14 years	21	1	7	7	6
Chemistry	A_2-up to 16 years	24	1	5	10	8

TABLE II
(1970 - 71)

Results with the Author's Evaluation System

			Achievement			
Characteristics	Categories	No. of Students	E'	G'	S'	U'
General Science	A_1-up to 14 years	21	9	4	6	2
Chemistry	A_2-up to 16 years	26	2	11	10	3

TABLE III
(1969 - 70)

Results with the Traditional System of Evaluation

			Achievement			
Characteristics	Categories	No. of Students	E'	G'	S'	U'
General Science	A -up to 14 years	35	3	10	15	8
Chemistry	A -up to 16 years	45	4	88	25	8

TABLE IV
(1969 - 70)

Results with the Author's Evaluation System

			Achievement			
Characteristics	Categories	No. of Students	E'	G'	S'	U'
General Science	A_1-up to 14 years	35	8	15	11	2
Chemistry	A_2-up to 16 years	45	8	14	20	3

NOTE: E=Excellent G=Good S=Satisfactory U=Unsatisfactory

The results on the previous page suggest that the students attained more when the author's evaluation system was used than with the traditional system. That they learned more is suggested by an increase in average test grades when viewed as a single criterion. There was a general increase in each class. Admittedly the study is not experimentally "clean" and one certainly cannot infer any causative relationship. Still, subjective observation suggests that some of the components built into the proposed evaluation scheme of Schematic II are tied to a positive shift in interest in the course. The writers believe that the proposed scheme builds on a feeling of reduced failure potential by the students, resulting in a reduced antipathy toward science. In the absence of a thoroughly controlled experiment, this is a tempting explanation of increased achievement.

These results are, of course, highly subjective in interpretation but the writers' strong feeling is that two very important factors are operating. First, the system makes it clear to the students that their grades are not entirely the result of their rote-learning performance as reflected in test grades. Second, the cycle of teaching and testing activities described reduces the feeling of finality - and hopelessness - attached to any given evaluation.

CHAPTER VIII

CONCLUSION

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Conclusion

We have been preaching for a long time the concept of "Equal Education" opportunities in our affluent society. This concept is based on a faulty assumption that all students are equally capable of responding to the opportunity of receiving education.

Furthermore, what is needed is an opportunity for all children to become equally educated. This implies that the children who are unfortunate enough to have poor environment, and who have a limited future should be given more educational facilities so that they can get maximum benefit from public educational facilities. Thus, these Native Indian students need well qualified, warm and understanding teachers. They need well equipped laboratories and a science program which caters to their needs, interests and capacities.

Also, a sincere attempt should be made to harmonize the Indian and non Indian values, prior to the offerings of any science program to the Students.

In order to facilitate meaningful science education for these students, compatible relations with these students should be established so as to build their confidence in the science class, in the school and in themselves.

The above conviction has been aptly described by Chief Dan George in Dramatic Soliloquy:

> "You talk big words of Integration in the schools. Does it really matter? Can we talk of integration of hearts and minds? You have only a physical presence - - - and the walls are as high as the mountain range.
>
> I know you must be saying - - - tell us what do you want? What do we want? We want first of all to be respected and to feel life - - - but we cannot succeed on your terms - - - We cannot raise ourselves on your norms. We need specialized help in the formative years - - - specialized help in education.
>
> But you have been kind to listen to me and I know that in your heart you wished you could help.
>
> I wonder if there is much you can do and yet there is a lot you can do - - - when you meet my children in your classrooms respect each one for what he is - - - a child

> of our Father in heaven and your brother. Maybe it all boils down to just that."[29]

The solution to the problem of making the Native Indian students interested in a science class is complex, but possible. In the opinion of this writer, a pre-requisite for success is the instilling of pride in the Indian scientific heritage. To achieve this objective, a science teacher should believe in the potential competence of these students with whom he works. The teacher must stress their scientific achievements in the science classroom.

Also, in the opinion of this author, Native Indian students should have positive attitudes toward science and school. They won't achieve anything by rejecting the present system of education. They should try to learn from the experiences of those Indian people who have achieved success.

Instead of cultural confrontation, cultural co-operation and integration should be established so that people from different ethnic groups can live together and learn from each other in this great country of Canada.

In conclusion, Native Indians and science educators need to make a very sincere effort to meet on a common ground and discuss, with no reservations, the major problems in science education.

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[29] From a recording by Chief Dan George, January 6, 1971, for the C.B.C. Radio Program "The Second Fifty."

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APPENDIX II

Useful Information For Teachers

(Biographical Information of Some Successful Indians)

Leonard S. Marchand (Member of Parliament for Kamloops-Cariboo, B.C.)

Len Marchand, 24, an Okanagan, became the first Indian M.P. by defeating former Tory Cabinet Minister Davie Fulton. Marchand is married with two children. He has a B.Sc. degree in Agriculture from the University of British Columbia and a Masters' degree in forestry from the University of Idaho.[1]

Mr. Len Marchand describes his school life in the following paragraphs.

I went to the reserve day school for grade one to eight and to Kamloops Indian Residential School for grade nine. I took my high school in Vernon and even though I was the first student from our reserve to go to Vernon High, I thought it was great. I did feel a little apprehensive and a little lost for a while, but my parents had friends in town and so, I found friends in high school that I'd known for quite a while. In a couple of months I was right at home and made a lot of new friends.

I completed high school in the general program, then found I didn't have the required courses to go on to University, so I decided to take an extra year and pick up the subjects I needed for University entrance. In October of that year, when the first report card came out, I had a D in one of the Maths and a D in something else. I was leaning on my locker outside the classroom just after I got my card. I decided I was going to quit, just going to pack it up. This was just not for me. One of my friends, a teacher, said: "Why don't you give it another try and see if it works." So, I went back and on my next report card my lowest mark was a C. I kept going and by the end of the year, I was recommended in all of my subjects. That was a really critical time in my life.

There were other people whose advice helped me too. We had a Band counsellor one time, James Bonneau, an uncle of mine. He used to say, "Do things yourself. Look after yourself. Don't depend on the government." His words impressed me. He'd talk about the Indian way of life, the way our ancestors lived, and the pride they had in being independent and would say, "We got along in this world as individuals before the Whiteman came."

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[1] Barbara Frum "The New Indian" Chatelaine, November 1968, p. 53.

Indians are a proud race. We have much in our past of which we are proud. Our culture can make an even greater contribution to Canada than the very considerable one it has already made. There is much about Indian life that is good and there is much for Canadians to learn about it. We have been held back but we are on the move today.

It is important for the younger Indians who are in school and at university to know that, with reasonable hope, they can aspire to become whatever they wish to become and are capable of becoming.[2]

Chief Dan George

Chief Dan George is an hereditary Chief of the Coast Salish tribe and honorary Chief of the Squamish tribe. He acted in the Vancouver Playhouse production of the Ecstasy of Rita Joe in 1968, and has recently completed films for the National Film Board. He was nominee for an Oscar Award for his role of best supporting actor in his new film of Little Big Man. On May 26, 1971 he was awarded an honourary Doctorate of Law by Simon Fraser University, British Columbia.[3]

The Rev. Ernest Willie

Indian name "Ka-Sa-Las" means "The way."

Mr. Willie grew up in Kingcome Inlet, a Kwakiutl Village 150 miles north of Vancouver. He attended St. Michael's residential school in Alert Bay and The Vancouver Vocational Institute. Before he fulfilled his ambition to become a priest, he worked as a fisherman and a carpenter. He received his theological training at Emmanuel College at the University of Saskatchewan, Saskatoon.

Mr. Willie worked as an assistant priest in the Kitsilano district and in Surrey and then accepted full parochial duties in Hatzic, a community east of Mission. On April 1, 1971, Mr. Willie became the social worker for the Squamish Indian Band in North Vancouver. He and his wife Maureen now live on the Mission Reserve in North Vancouver. They have a one year old daughter, Janine.

Michael Mitchell

Michael Mitchell, 22, an Iroquois, is one of six young Indians being trained with the National Film Board in Montreal as directors, cameramen, soundmen, so that ultimately they can produce their own films: to help reserves learn about each other, and to tell Indian history as Indian people feel it has never been told before. Mitchell is from St. Regis Reserve near Cornwall, Ontario. Married, with two children, he says, "We can educate our children to be able to make their way in the white world, but they have to know themselves first, their background. Too many young people feel lost between two societies."[4]

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[2] Kent Gooderham (Edited), I am an Indian (Toronto: J.M.Dent & Sons (Canada) Ltd.), 1969, pp. 40-43

[3] Waubageshig (Edited), The Only Good Indians (Toronto: New Press Sussex Avenue, 1970. pp. 184

Jim Turner

Jim Turner, 41, never a treaty Indian, has been in Toronto ever since he came to the city to high school from the Indian community of Bear Island on Lake Temogami. "Five years ago I was one of the founders of the Indian Friendship Centre here, and I have never experienced any pressure to stop thinking of myself as Indian."

Turner has a B.Sc. from the University of Ottawa and teaches high school mathematics in a Toronto Suburb.[5]

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[4] Frum, Op, Cit., pp. 53

[5] Ibid, pp. 53